



US GRENADE LAUNCHERS

M79, M203, and M320

GORDON L. ROTTMAN





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Series Editor Martin Pegler

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INTRODUCTION

Since World War I the basic weapons of the rifle squad have been the rifle, bayonet, light machine gun (LMG), and hand and rifle grenades. These weapons provided the 8–13-man squad – three to a rifle platoon, plus sometimes a weapons squad with LMGs and antitank (AT) weapons – with the ability to engage the enemy at ranges varying from pointblank to over 500yd. Most of the squad’s direct point target firepower is provided by its one or two LMGs and 6–10 rifles. For short-ranged area targets, the use of high-explosive munitions has been provided by hand and rifle grenades. Hand grenades have a realistic range of 30–45yd and rifle grenades seldom effectively reached over 110yd. Platoon/company-level light (50mm) mortars might range up to 325–875yd only and had a close-range gap of 55–110yd from the forward positions. Hand and rifle grenades were often inadequate to fill the gap, plus rifle grenades had a slow rate of fire and were ill-suited for accurate indirect fire. Providing the squad with a light weapon capable of delivering direct and indirect HE/frag fire would clearly be beneficial.

In the early 1950s the United States began development of a unique weapon to fill the HE direct- and indirect-fire gap. It could also fire shotgun-like multiple projectiles, rounds capable of defeating light armor and hardened positions, smoke screening, pyrotechnic smoke and flare signaling, illumination, and non-lethal munitions. The introduction of this highly flexible weapon – the 40mm M79 grenade launcher (GL) – led to the virtual demise of the rifle grenade launcher (RGL).

The lightweight, compact, shoulder-fired M79 was what would become known as a “standalone grenade launcher.” It was realized that for each GL equipping a squad, a rifle was sacrificed, so a means of adapting the GL to be fitted on a rifle as an even more encompassing multipurpose weapon was sought. This became known as an “under-barrel grenade launcher” (UBGL). The requirement for standalone GLs remained and some UBGLs can be dismounted from their rifles, fitted with buttstock and grip



The "launcher, grenade, 40mm, M79" – Federal Stock Number 1010-691-1382 (changed to National Stock Number 1010-00-690-5126 in 1975) – as issued in Vietnam, this one with a plastic buttstock and the more common solid black rubber recoil pad. Walnut-wood stocks were also common. The detent button on the forward end of the trigger guard is the release allowing the guard to be pivoted right or left to allow firing with gloves or trigger-finger mittens. (US Air Force)

assemblies, and used as standalone GLs. Most GLs are single-shot to provide simple reliable designs and reduce their weight and bulk, especially important when mounted on host weapons. Repeating, magazine-fed GLs have been attempted, but proved to be too heavy and complex.

This book investigates the 40mm M79, XM148, M203, M320, and M32 GLs employed as standalone and/or under-barrel GLs. The T148 and China Lake multiple grenade launchers (MGLs) are also briefly examined. The heavier belt- or magazine-fed, full-automatic 40mm grenade machine guns mounted on tripods, ground vehicles, watercraft, and helicopters are not covered. Three MGLs firing low-velocity 40×46mm rounds were developed for use on watercraft and ground vehicles (Mk 18 Mod 0, Mk 20 Mod 0, and XM174).

The M79 GL first saw combat use with 3d Battalion, 9th Marines, 3d Marine Division after arriving in Vietnam in March 1965 – the first US infantry unit to deploy there. The battalion's Command Chronology does not specifically mention the M79, but an unnamed US Marine Corps grenadier fired the first 40mm grenade in combat early in the month when suspected enemy were detected outside the base perimeter. The US Army's first combat use of the M79 was in April 1965 by 3d Brigade, 82d Airborne Division during the Dominican Republic Intervention where it proved its value in urban combat. The deploying 173d Airborne Brigade saw the US Army's first opportunity to engage with the M79 in Vietnam in June 1965. From these humble beginnings the value of the M79 and related developmental weapons was soon realized.



An M4A1 carbine mounting an M203A2 UBGL cracks off a 5.56mm round. An EGOS-N M68 close-combat optical sight is fitted to the Picatinny rail atop the receiver. (US Army)



DEVELOPMENT

The squad's artillery

FORERUNNERS

The oldest – and for a long time, the only – means for infantry to deliver high explosives was the hand grenade. From the 1500s until the turn of the 20th century, the hand grenade was a 2–6lb cast-iron sphere filled with a few ounces of gunpowder with a wick. These early weapons' range was limited, fragmentation was irregular, they only broke up in a few large pieces, and they were hazardous to grenadiers. In the 17th and early 18th centuries, limited use was made of flintlock hand mortars or “cohorns,” named after the Dutch general and military engineer, Menno van Coehoorn (1641–1704). They typically had 4–6in-long barrels of 2–2.5in caliber with a buttstock. A hand grenade was inserted with fuse wick up and when fired the fuse ignited and detonated with an air or ground burst. They were little used, being outrageously dangerous due to premature detonations.

By the late 1700s most European armies had established grenadier units handpicked for their height, throwing ability, and bravery. With their distinctive tall hats and elaborately monogrammed grenade bags, they were elite troops and often escorted royalty, nobility, and dignitaries. By the late 1800s there were still grenadier units, but the title was more of an honorarium, grenades having fallen from use.

World War I was the “golden age” of grenades with scores of new models fielded. Initially they were mainly used by engineers/pioneers, the new assault troops, or by assault subunits within rifle platoons and companies. While grenadiers/bomb-throwers operated as a part of these assault teams, grenades were also supplied to rank-and-file riflemen. Over the years a wide variety of hand grenades evolved to include HE/fragmentation, blast concussion, antitank (high-explosive antitank – shaped charge – or blast-type), incendiary, bursting-type casualty-producing

smoke (white phosphorus), burning-type screening smoke, burning-type colored signaling smoke, incendiary, tear gas/riot control, and stun/flash-bang.

Realistically, in combat – taking into account stress, exhaustion, poor rations, and restrictive uniforms and equipment – the maximum range of hand-thrown grenades was 30–40m. To provide the platoon with the capability to project grenades farther, the rifle grenade was introduced in 1905. A key benefit was that it did not require a new weapon for firing: a standard service rifle was used. All that was necessary was a device to hold the grenade on the rifle's muzzle. This could be a cup-like device holding the grenade which was usually spin-stabilized, the spin being imparted by rifling – twisting grooves inside the discharger cup. Another device was the spigot launcher, a tube fitted to the rifle's muzzle. The grenade itself had a finned tubular tailboom for stability.

Most rifle grenades required a special bullet-less launching cartridge to propel the grenade. A few types allowed standard ball ammunition to be used. The earliest type of rifle grenade was the rod type, which possessed a rod that was inserted into the rifle's barrel. The rod and cloth streamers provided stability. Rod-type grenades disappeared from service by the end of World War I, but both cup- and spigot-type rifle grenades remained in use through and after World War II.

Grenade launchers could deliver a grenade 2–5 times the range of hand grenades. They were area-fire weapons except when used at close range for direct fire, usually less than 85yd. Direct fire was achieved by shoulder firing, suffering heavy recoil in the process, or with the rifle's butt tightly clamped under the arm. Indirect fire was achieved by firing at a high angle of elevation with the rifle's butt on the ground. High-angle range was estimated by bracketing the target – a skill learned through experience. Grenade-launcher sights were available to measure the rifle's angle of elevation. Rifle grenades were available in the same explosive types as hand grenades but also as projectiles used for signaling, including colored flares and smoke and parachute-suspended illumination flares.

At the beginning of World War II the first munitions developed by most armies bearing the new antitank shaped charge were rifle grenades. The German Army developed grenade cartridges for its 2.6cm flare pistol with short barrel (*Leuchtpistole mit kurzem Lauf* – LeuP). This was a single-shot, break-open, smoothbore flare pistol for which over 40 color signal flares, burning-type smoke, and smoke streamer cartridges were available. Unique among the grenade rounds was the “thrown projectile 361,” which required a 2.3cm-caliber reinforcing, rifled insert barrel liner.



Two US Marines prepare to fire an Energa M28 HEAT rifle grenade from an experimental T119 RGL fitted on an M1 Garand rifle. The T119 launcher with an integral folding ladder-type sight saw only limited field testing during 1950–52. The M7A3 RGL was adopted in 1952 instead. RGLs were marginally accurate, especially when fired at a high angle of elevation for long range, as here. The T119 configuration is typical of the period's RGLs. (Tom Laemlein/Armor Plate Press)

Special variants of the flare pistol included the combat pistol (*Kampfpistole* – KmP), issued in 1941, and the assault pistol 1942 (*Sturmpistole 42* – StP 42). Both had rifled barrels allowing them to fire special 2.6cm combat cartridges for close combat in built-up areas. They could also fire 2.6cm signaling pyrotechnics. The KmP appeared similar to the flare pistol, but had an integral rifled barrel and dial-type rear sight. The StP 42 had a rifled barrel, folding shoulder stock, and a folding sight assembly. The barrel insert was required for the over-caliber projectiles. Both of these weapons had heavy recoil and the small 2.6cm HE rounds were of only limited effectiveness. These pistols could fire HE, white smoke to mark enemy targets, orange smoke to mark friendly positions, a parachute illumination flare, and a message cartridge.

At the end of World War II US Ordnance discovered German prototype shoulder-fired GLs using the above cartridges. The assault combat rifle (*Sturmkampfgewehr* – StKG) was based on a Mauser Kar 98k bolt-action carbine with a short 2.6cm break-open barrel. The cartridge was breech-loaded, closed, and the bolt-action worked to cock the weapon. These weapons no doubt inspired the M79.

An Italian device that may have inspired both the M79 and XM148 was the 38mm Mod 28 *Tromboncino* (small blunderbuss) grenade discharger. This was a barrel and receiver assembly mounted on the right side of 6.5mm Mannlicher-Carcano Mod 91/28 special troops carbines. The barrel was muzzle-loaded with an HE/frag projectile like a finned, teardrop-shaped aerial bomb. A spring-stop retained the projectile in the 5.5in barrel if pointed downward. The launcher was unique in that the bolt was removed from the carbine's receiver and inserted into the launcher. A 6.5×52mm ball cartridge was hand-loaded. A leaf-type rear sight graduated to 200m (219yd) was fitted on the carbine and used in conjunction with the normal front sight. The carbine's trigger was linked to the launcher and when fired, the bullet was trapped in a combustion chamber in front of the cartridge chamber. Expanding gas was vented through four holes into the 38mm barrel to propel the projectile – a crude high- and low-pressure system. Opening the bolt ejected the spent cartridge and the trapped bullet fell out. The projectile lacked power, had mediocre accuracy and a slow rate of fire, and threw the carbine off balance for normal shooting. Production ceased in 1934 and it was replaced by the 45mm Mod 35 *Brixia* assault mortar.

Another influence for the M79 came from Japan in the form of three or four 5cm Type 89 (1929) grenade dischargers, known to Allied personnel as “knee mortars,” in a rifle platoon. These dischargers fired mortar projectiles (HE, incendiary/smoke), flare and smoke signal rounds, and special hand grenades with propelling charges. They were much disliked by the Allies as they were brought into action very quickly to deliver a high volume of accurate, close-in fires on assaulting infantrymen. An experienced crew could fire at rates of up to 25rd/min over ranges up to 650m (710yd) with mortar rounds and 200m (219yd) with grenades. They outperformed rifle grenades in range, rate of fire, and accuracy. The US tested their own 60mm versions firing modified hand grenades, but never adopted any.

WHERE HAVE ALL THE RIFLE GRENADES GONE?

By the end of the Korean War (1950–53) the United States was using the M7A3 rifle grenade launcher on the .30-caliber M1 Garand rifle. This version, adopted in 1952, was capable of launching the heavy Belgian ENERGA M28 and larger M31 HEAT grenades.

The M76 (T140) RGL, production of which began in 1961, was developed for the 7.62mm M14 rifle even though the XM79 was already under development. The M76 was necessary to launch HEAT rifle grenades and pyrotechnic smoke and flare signals, and it remained in limited use with M14-armed units alongside M79s until M14s were replaced by 5.56mm M16A1s.

To improve accuracy, the M15 (T59E3) tilting bar-type RGL sight could be fitted on the left side of the M14's stock, though it required a mounting plate screwed onto the stock using a template. The sight could be detached if not needed; but it was seldom used, with grenadiers simply estimating the angle of fire for the desired range.

Rifle grenades and signals could be launched from the M16A1 rifle, but it proved ill-suited for the task. The flash suppressor was the NATO-standard 22mm diameter and rifle grenades could be slid onto it. No special launcher device was necessary. A ladder-type grenade sight was clipped to the rifle's front-sight bracket. Being so short, however, the suppressor did not adequately support heavy grenades. A circular spring clip had to be fixed to the suppressor and the suppressor removed to do so. Nor could the rifle butt be placed on the ground for high-angle firing owing to possible damage. Firing grenades from M16A1s was finally restricted. Other problems with rifle grenades were heavy recoil, inaccuracy, and short ranges – the M31 HEAT grenade had a maximum effective range of 175m (191yd).



The M76 (T140) rifle grenade launcher was developed in the late 1950s and first issued in 1961 for use on the 7.62mm M14 rifle. It became obsolete owing to the advent of 40mm grenade launchers, M72 LAW antitank rocket launchers, and “pop-up” rocket-assisted ground signals. (USNPS Photo, Springfield Armory National Historic Site, SPAR 4909)



Measuring 9in long overall, the M7A3 rifle grenade launcher for the .30-caliber M1 Garand rifle was standardized in September 1952. It was longer than the earlier models, having additional range rings to accommodate the large M28 and M31 HEAT grenades. (USNPS Photo, Springfield Armory National Historic Site, SPAR 4896)

For small-unit AT defense, HEAT rifle grenades and 3.5in M20A1B1 rocket launchers (the “bazooka”) were available. As the platoon's primary AT weapon the bazooka was replaced by the 90mm M67 recoilless rifle in the early 1960s. Headquarters and support elements were still armed with the bazooka for self-defense, but did without dedicated crews. The “three-point-five” in that role began to be replaced in 1963. Weighing 5.1lb, the 66mm M72 Light Antitank Weapon (the LAW) was a single-shot, disposable, shoulder-fired rocket launcher using the M31 HEAT grenade's warhead. The LAW achieved much better penetration than most HEAT rifle grenades, was more accurate, and offered a greater range. Loaded in a telescoping tube doubling as the launcher tube and shipping/storage container, it was issued as a munition.

Besides launching HE/frag and HEAT grenades, RGLs projected pyrotechnic signals: parachute star, star cluster, parachute smoke, and smoke streamer. Replacements for these rifle-launched signals were also under development in the form of handheld ground signals – small self-contained rocket-propelled signals packed in 1.67×10.16in launcher tubes. Better known as “pop-ups,” they were launched by removing a muzzle cap and slipping it onto the bottom end of the launcher tube with the primer. A firing pin was fixed inside the cap. The launcher tube was aimed skyward and the cap slapped with the palm to launch the signal, thus eliminating the need for an RGL and launcher cartridges.

Pyrotechnic signal rounds were eventually developed for the M79, but they augmented rather than replaced pop-ups as they had limited altitude and brief payload burn duration.



This T1 grenade launcher mounted on a 7.62mm M14 rifle is one of several one-off experimental 40mm UBGLs. A simplified tangent-type grenade-launcher sight is fitted beside the host weapon's receiver. The T1 proved to be too heavy on an already heavy rifle, and being mounted so far forward made it awkward to handle. (USNPS Photo, Springfield Armory National Historic Site, SPAR 7186)

40mm AMMUNITION

Antecedents

In 1943 the German Army was in desperate need of AT weapons and open to all concepts. The 5cm and 7.5cm AT guns were obsolescent and inadequate. The 8.8cm Flak gun pressed into the AT role was deadly, but too heavy and large to be tactically viable. Two innovative weapons were the bazooka-like 8.8cm *Panzerschreck* and the one-shot *Panzerfaust*. Short-ranged and marginally effective, they were nevertheless deadly if employed in sufficient numbers. Even so, development of a new weapon offering longer range plus greater accuracy and lethality was critical.

One of many proposals was the Rheinmetall-Borsig 8cm (3.14in) Panzerabwehrwerfer (armor defense weapon) 600, a smoothbore gun firing a lightweight fin-stabilized, shaped-charge projectile. Rheinmetall developed the *Hoch- und Niederdruck System* (high- and low-pressure system) to achieve a lighter weapon. The system confined the propellant's detonation in the breech with a perforated plate rather than the high-pressure propellant enacting directly on the projectile. It "bled" the expanding gas into the chamber behind the projectile to propel it with lower pressure. Although this reduced velocity and range, the projectile reached normal engagement ranges. (Reduced velocity was of little consequence as shaped-charge rounds achieve the same penetration regardless of velocity and range.) The resulting weapon had the same penetration at 500m (547yd) as the 7.5cm PaK 40 AT gun and could reach 750m (820yd) while attaining the same penetration. The PAW 600, while about the same size as a PaK 40, was half as heavy (the high- and low-pressure ammunition's light recoil allowed for a much lighter barrel and carriage) and cost half as much to produce. Nevertheless, only 250 PAW 600s, redesignated PAW 8H63, were built. While none saw combat, the firing system proved viable and American engineers scrutinized it with another application in mind.

First steps

During 1950–53 the Ballistic Research Laboratories, Aberdeen Proving Ground, MD developed an effective 40mm HE/frag projectile. Picatinny Arsenal at Dover, NJ oversaw development. The design goal was 400m (437yd) at 250ft/sec and no more recoil than a 12-gauge shotgun. The challenge was how to launch the projectile to achieve better range and accuracy than a rifle grenade. The projectile development program was titled Project Niblick after the No. 9 iron, a high-lofting golf club, owing to the grenade's appearance in flight. The name was bestowed by Jack Bird, Small Arms Development Division at Aberdeen, an avid golfer, after building a demonstration device that launched golf balls. Numerous launcher designs were examined during 1952–55, most being M1 Garand rifle muzzle-fittings that offered no advantage over RGLs. Projectiles with extended skirts were tried for drag-stabilization. There were also heavy, complex, three-round magazine-fed, semiautomatic attachments on M1 rifles.



An M203 UBGL with its special boxy forearm on an M16A3 rifle used only by the US Navy (SEALs, Seabees, shipboard arms lockers). The M16A3 is full-automatic capable while the M16A2 and M16A4 have three-round-burst capability instead. The folding leaf sight at the forward end of the forearm is used in conjunction with the host weapon's normal front sight. An M406 HE round is being loaded. (US Navy)

A blunt-nosed projectile with a high- and low-pressure propellant system was found to offer the longest range and consistent accuracy. The 40×46mm (1.85in-long case) HE cartridge was unique in that for a large-caliber cartridge it had little recoil, was comparatively quiet, and generated negligible muzzle flash.

For the different types of HE rounds the muzzle velocity was 250ft/sec. They had a maximum effective range against area targets to 350m (383yd) and point targets to 150m (164yd). Minimum safe firing range was 31m (34yd) in combat and 130m (142yd) on training ranges, changed to 165m (180yd) in 1985. A round could travel over 2,000m (2,187yd). Safe firing temperatures for most types of rounds had a lower limit of -25°F and an upper limit of +110°F.

Low- and high-velocity rounds

The ammunition used in shoulder-fired GLs is of the “low-velocity” type. The other type is the 40×53mm “high-velocity” with an average muzzle velocity of 795ft/sec. These are for full-automatic belt-fed grenade machine guns such as the M75, M129, Mk 19, and Mk 47, firing high-velocity 40×53mm (2.09in-long case) rounds. While they appear similar, the two types of rounds are of different lengths and *not* interchangeable, but will chamber in both types of weapons. High-velocity rounds fired in a low-velocity GL will cause injury or death to the user, however. Low-velocity rounds fired in a high-velocity GL may jam or fail to fire. There are numerous types of 40×46mm rounds made in Austria, Croatia, Egypt, Germany, Poland, Romania, Singapore, South Africa, South Korea, and Switzerland that do not have US equivalents, and their markings and means of identification are different. Variations of colors and markings will be found in US rounds as well. (Russian 40mm rounds for the muzzle-loading GP-25, GP-30, and GP-34 UBGLs are entirely different from the 40×46mm rounds and not interchangeable. Projectile lengths are 3.9in and 4.8in with integral propellant charges.)

The design of the cartridge case is important to the round's function. It is semirimmed, i.e., an extractor groove with the rim slightly larger in diameter than the case's base above the groove. The aluminum M118 case contains an integral propellant cup with .32g (5 grains) of M9 smokeless propellant with an M42 primer in an aluminum adapter plug. This brass-lined cup serves as the high-pressure chamber momentarily containing the propellant's detonation at 35,000psi. Six tiny vents in the cup's thick walls allow the detonating propellant to pierce the brass lining and expand into the rest of the case – low-pressure chamber – which is void. The pressure is reduced to 3,000psi (M14 rifle chamber pressure is 50,000psi). The expanding propellant gases in the low-pressure chamber force the projectile through the barrel at a low velocity with minimal firing signature: sound, flash, smoke, with low bore wear. Most cartridges have varied shade OD or green anodized cases – an electrolytic process applying a protective oxide coating. Special-purpose cartridges may have entirely different case designs, including plastic.

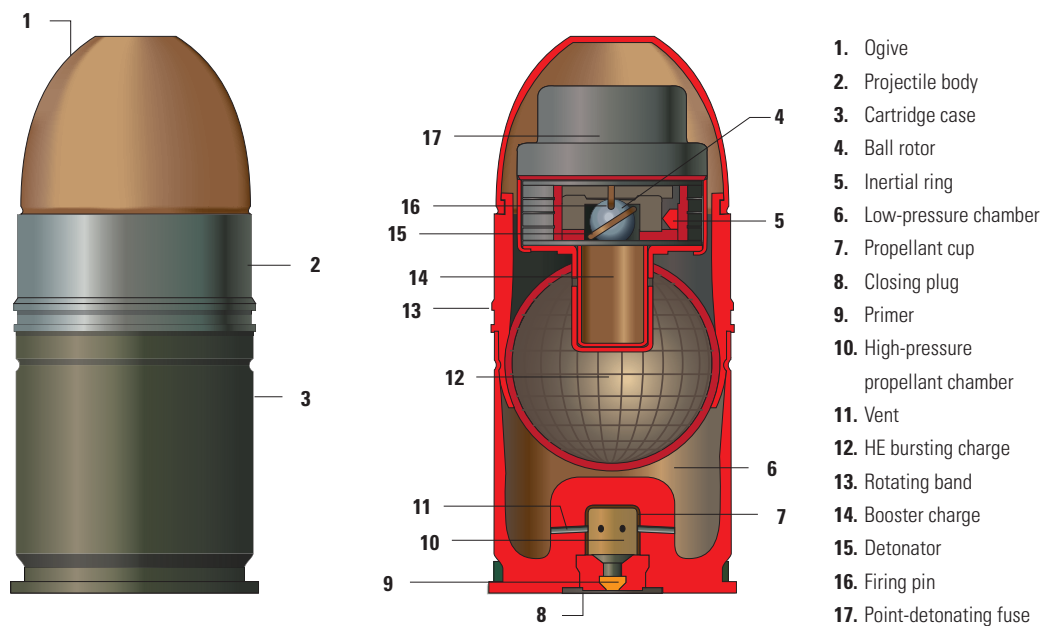
HE projectiles are quite complex. The projectile's aluminum body is a skirt with a rotating band around its base where it is crimped into the case. The thin aluminum ogive or nose cap may be rounded or flat-nosed. The point-detonating fuse, occupying over half of the projectile, is contained in the ogive and threaded to the booster charge, which is fitted in the bursting charge: 31.75g (490 grains) Composition B (relative effectiveness factor is 1.33 compared to TNT's baseline 1). The charge is either a sphere of wound $\frac{1}{8}$ in $\times$ $\frac{1}{12}$ in wire notched every $\frac{1}{8}$ in (M381) or a steel sphere internally pre-scored with similar-sized fragmentation segments (M406 and M441). Besides the steel fragments, other fragments are generated by the shattered fuse, ogive, and body for a total of over 300 fragments. The casualty radius is 5m (16.4ft) – at least half of exposed personnel are disabled. (Recent publications call this a “kill radius,” but it is properly a “casualty radius” meaning at least 50 percent of personnel are killed or wounded.) The possible casualty radius is 130–154m (427–505ft), but with little chance of being struck beyond the incapacitation radius of 15m (49ft).

The fuse is bore-safe as it does not arm until the projectile travels a preset distance at 3,600 rotations per minute. The first fuse was the M552 (T333), which armed at 2.4–3m (7.9–9.8ft) meaning it armed within the casualty radius, thus posing a serious danger – if the projectile struck intervening vegetation, the round would detonate near friendlies. There were also incidents when a GL accidentally discharged in a movement formation with the round striking the ground among friendly troops. To counter this, grenadiers carried M79s with a chambered round, but the barrel broken open to prevent accidental discharge.

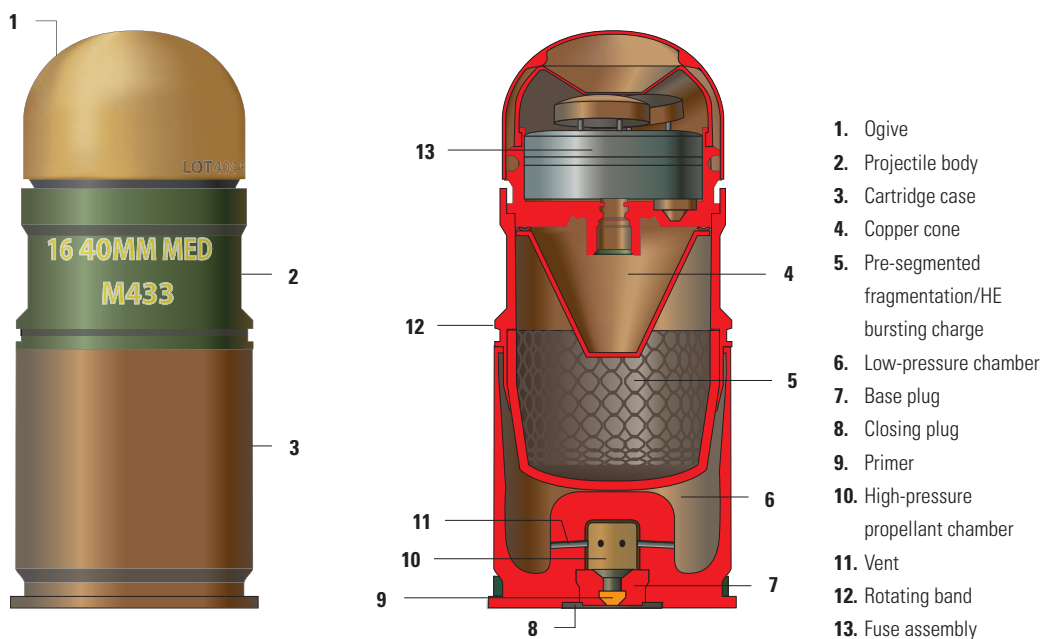
To correct this fault the M551 (T359) fuse was used which armed at 14–27m (46–89ft), requiring over 150 rotations. This kept the grenadier out of the incapacitation radius. The rounds with the short-arming M552 fuse were the M381 HE and M382 TP. The new round with the long-arming M551 fuse was the M386 HE – the short-arming M382 TP was retained. The M406 HE had a steel explosive sphere with the long-arming M551 fuse. The M441 had a short-arming M522 fuse with a steel explosive sphere as there were applications requiring short-arming fuses.

HE AND HEDP ROUNDS

M406 HE



M433 HEDP



Special-purpose rounds

The first special-purpose rounds were the M397 and M397A1 HE airburst, aka “jump-up frag.” They contained 32g (494 grains) of Octol with a relative effect to TNT of 1.54. This round’s goal was to increase the casualty radius with a 5ft near-surface burst or a burst over an open-topped position. Upon impact the bursting charge was ejected by an M55 detonator and exploded after an 80-millisecond delay. It functioned better in snow and mud, conditions in which a normal grenade’s blast and fragmentation was partly smothered. The rounds did not always function properly (4in of snow/mud increases dud probability, as a soft impact fails to activate the impact fuse) and were deemed not worth the extra expense.

The M463 smokeless and flashless HE contained a piston that remained in the case after firing and budged out an aluminum diaphragm that contained the propellant detonation, greatly reducing the sound signature. Range was reduced and erratic; the round proved unnecessary, and was withdrawn.

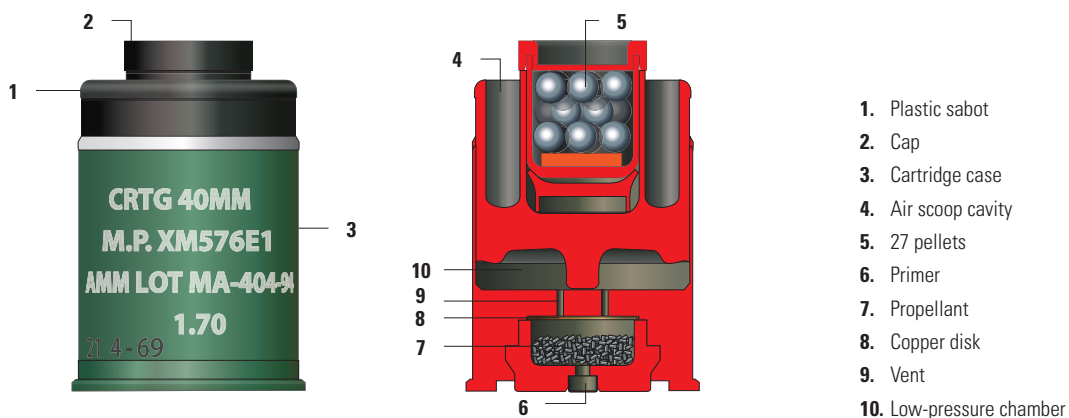
The M433 HEDP, fielded in 1971, possesses a shaped charge capable of penetrating 50–55mm (1.97–2.17in) of armor at zero degrees impact plus up to 12in of pine logs, 16in of sand-filled cinder blocks (two layers), and 20in of sandbags (two layers). A regular HE round may or may not penetrate a 2in plank of wood. Besides penetrating hardened materials, when the charge detonates it shatters the fragmentation cup and body generating fragments that spread outward with a 5m (16.5ft) casualty radius. The projectile uses an M550 point-detonating fuse – less than ideal for a shaped charge, but necessary due to internal space limitations. The copper cone’s cavity is held in a pre-scored internally segmented cup containing 45g (694 grains) of Composition A.

Efforts were made to provide antipersonnel rounds to engage personnel within fuse-arming range. The first began in 1963, with the program accelerated in late 1965 and the first rounds delivered in Vietnam in March 1966. This was the multiple projectile (MP) loaded with buckshot. (MP does not mean “multipurpose” as manuals published before 1987 stated in error.) Both of the experimental MP rounds held No. 4 (.24in) 24g (370-grain) hardened buckshot pellets in plastic sabots. The XM576E1 contained 20 pellets in a central cup about the size of a 12-gauge shotgun shell protruding slightly from the plastic sabot for controlled dispersion. The sabot had six air cavities slowing it and expelled the shot, putting at least 13 pellets into a 1.5m (4.9ft) circle at 40m (44yd). Later standardized as the M576, it saw wide issue. The XM576E2 held 27 pellets in a bore-width, capped, one pellet-deep depression in the sabot. The pellets’ dispersal proved to be too wide. The green M199 case was rimmed to prevent its use in grenade machine guns.

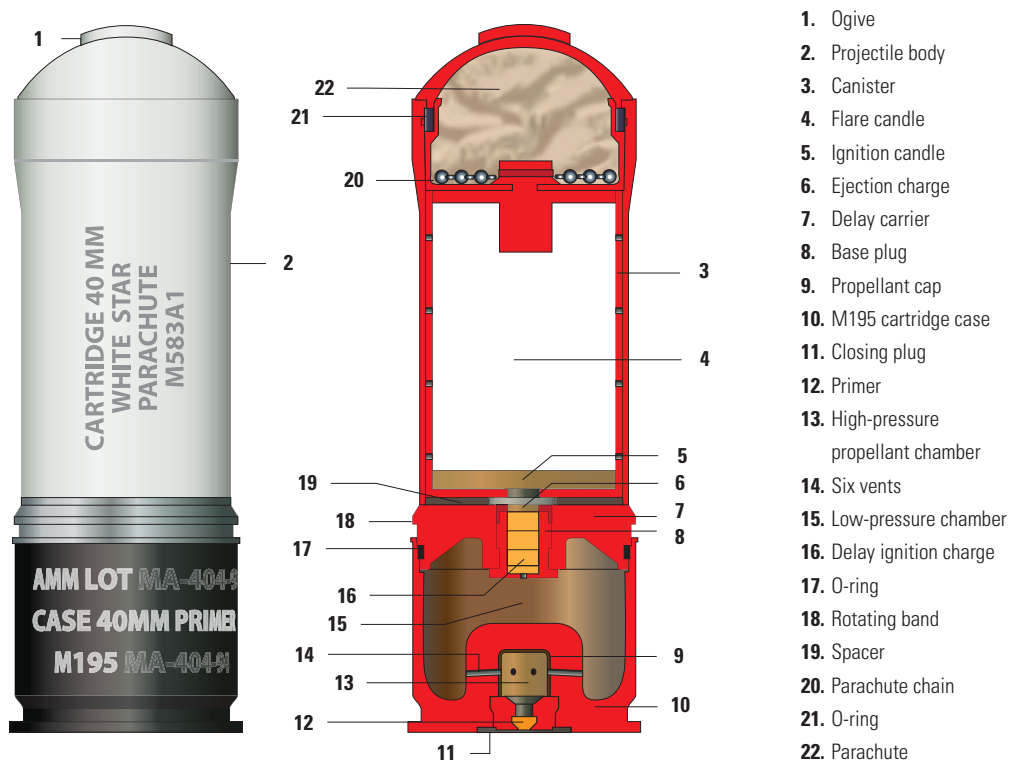
The XM107 antipersonnel (A-PERS) was loaded with 45 flechettes resembling finishing nails with fins. The darts were 1.125in long and weighed .65g (10 grains). To maximize the number of flechettes, half were packed with their fins reversed, all in a steel cup. When fired the XM107 functioned with a “muzzle action,” i.e., “shotgun effect,” the flechettes spreading from the muzzle and lethal to 40m (44yd). The reversed flechettes did not fly point first until 15–30m (16–33yd). At close ranges half the

MULTIPURPOSE AND PARACHUTE ROUNDS

XM576E1



M583A1



flechettes struck targets reversed or sideways, making them less effective. US Navy SEALs found that the flechettes traveled at too low a velocity and were too light to inflict much damage. Buckshot was more effective.

The M651 CS (tear gas) is best used in dense vegetation for breaking contact and firing into structures at up to 200m (219yd). The aluminum projectile penetrated .5in windows and .75in softwood boards – a hit can be fatal. There is no bursting charge; the 56.7g (875 grains) of CS/pyrotechnic powder burns for 20–30 seconds covering an area 120m square. The case rim has six notches to help distinguish it from other rounds when used at night.

Non-lethal rounds include the M1006 “sponge grenade” or “rubber bullet” with a hard rubber projectile with a plastic rear cup. The cartridge case is plastic. Its effective range is 10–50m (11–55yd) and a strike can temporarily incapacitate. A hit at under 10m (11yd) causes serious injury or death.

The 2001 M1029 crowd-dispersal cartridge consists of a plastic case containing 48 black hard rubber .48in balls. Its range is 15–30m and it will halt, disorient, and temporarily incapacitate leaving painful welts.

The XM1060 multipurpose cartridge has a YJ-05 thermobaric mixture-filled projectile (unnamed high-velocity explosive and powdered aluminum) creating an intense over-pressure blast and thermo-flash. Used in Afghanistan since 2003, it is effective against buildings, bunkers, and caves.

The need for pyrotechnic cartridges was foreseen when development of the XM79 GL commenced. Development began in 1962, but was suspended in 1964. However, the need for signal cartridges was called for from Vietnam and development of the XM583 white star parachute and XM585 white star cluster moved ahead. The first rounds were issued in May 1966.

Pyrotechnic signaling and marking cartridges vary in design. The star parachute signals include the M583/M583A1 white, M661 green, and M662 red. These rounds have a fiber tube in a short M195 case with a plastic nose cap. The colored flare is contained in the ejected canister with a 20in-diameter parachute. At an altitude of 500–700ft the flare ignites and burns for 40 seconds, visible up to 3 miles. The 90,000-candlepower white star can be used for battlefield illumination.

The M585 white star cluster expels five freefalling stars after a 4–5-second delay at 550ft to burn for 7 seconds at 55,000-candlepower. The XM663 green and XM664 red star clusters have been described in references, but are not listed in TM 43-0001-28.

The M676 yellow, M680 white, and M682 red smoke canopy cartridges contain a burning smoke charge and parachute. The charge bursts at 300ft, burns for 90 seconds, and is used as a day signal fired through moderately dense overhead foliage. The rotating parachute is intended to entangle in foliage so the unit’s position can be determined by aircraft.

The M713 red, M715 green, and M716 yellow smoke ground-marker cartridges resemble HE rounds with M118 cases and blunt aluminum projectiles. When fired, a delay element ignites and arms at 15–45m



US Marines in training fire M32A1 MGLs at a high angle for long-range fire. Note that the adjustable buttstock is raised so that it can be maintained in a more or less horizontal position while the MGL is angled upward to achieve long range. The light-blue plastic projectile – an M781 training practice round – can be seen about 4ft beyond the muzzle. (US Marine Corps)

(16–49yd) when it starts to stream colored smoke. Upon impact the main smoke charge ignites and burns for 17 seconds to identify targets to aircraft and ground troops.

The 1996 M992 infrared illuminate cartridge contains a candle that burns with an infrared illuminate, with the illuminated area only visible with an infrared sight/viewer. The parachute descends at 7ft/sec after being expelled and ignites at 500–700ft to burn for 30–40 seconds.

The XM674 CS and XM675 red smoke cartridges were unique, being 8.81in long and issued in four-pocket bandoleers. They could be fired from an M79 by breech-loading after the cartridge muzzle cap was removed; from an AN-M8 pyrotechnic pistol by removing the muzzle cap and the plastic rimmed adapter for M79 firing and muzzle-loading it into the pistol; or by removing the plastic adapter and muzzle cap with an integral firing pin, placing it on the primer end, and firing it by slapping the hand on the cap's bottom like a "pop-up" signal. They could not be loaded in an M203 unless the barrel was first removed, loaded, and reattached. Range was 70m (77yd) with a 12–36-second burn time. The red smoke was for training in the use of the CS cartridge.

Target-practice (TP) rounds include the M382 with a short-arming M552 fuse; it was essentially an M381 with its HE charge replaced by a booster pellet expelling a yellow powder puff on impact. The M407A1 TP had a long-arming M551 fuse and a plastic sphere with more yellow-dye powder for a larger marking burst. The M781 TP is a cheaper round with a low-cost primer and plastic projectile that simply shatters to disperse orange marker powder ("chalk round").

37mm AN-M8 pyrotechnic pistol and M9 hand pyrotechnic projector rounds can be fired from single-shot GLs along with commercial 37mm tear gas, smoke, and flares.

40×46mm CARTRIDGE IDENTIFICATION			
Model/type	Identification	Length	Remarks
M381 HE	yellow nose, steel body	3.89in	short-arming
M382 TP	dull-silver or OD nose, steel body	3.89in	short-arming
M386 HE	yellow nose, steel body	3.89in	long-arming
M397/M397A1 HE airburst	light-OD or cream nose, steel body	4.05in	“jumping frag”
M406 HE	gold nose, steel body	3.89in	long-arming
M407A1 TP	light-blue nose, steel body	3.89in	long-arming
M441 HE	gold nose, steel body	3.89in	short-arming
M443 HEDP	gold or orange nose, steel body	4.05in	shaped charge/frag
M463 HE	black nose, steel body	3.89in	smokeless and flashless
M583A1 white star parachute	white cap with raised “W,” white body	5.27in	parachute
M585 white star cluster	white cap with five pimples and raised “W,” white body	5.26in	five stars
M651 CS	gray nose, red band, six rim notches	4.57in	tear gas
M661 green star parachute	green cap with raised “G,” white body	5.27in	parachute
M662 red star parachute	red cap with raised “R,” white body	5.27in	parachute
M676 yellow smoke canopy	yellow cap with raised “Y,” white body	5.21in	parachute
M680 white smoke canopy	white cap with raised “W,” white body	5.21in	parachute
M682 red smoke canopy	red cap with raised “R,” white body	5.21in	parachute
M713 red smoke ground marker	red tip, light-green projectile	3.91in	streamer and burning
M715 green smoke ground marker	green tip, light-green projectile	3.91in	streamer and burning
M716 yellow smoke ground marker	yellow tip, light-green projectile	3.91in	streamer and burning
M781 TP	light-blue plastic projectile, white case	4.05in	impact-bursting
M992 infrared illuminate	orange band and cap with raised “I,” white body	5.27in	parachute
M1006 non-lethal	green projectile, black body, white case	4.95in	sponge grenade
M1029 crowd dispersal	green band, raised “B,” steel case	4.80in	48 rubber balls
XM107 A-PERS	black body, case, and cap with eight indents	3.89in	45 flechettes
XM576E1 MP (M576)	short black sabot, green case	2.64in	20 buckshot
XM576E2 MP	green cap, green case	2.50in	27 buckshot
XM674 CS	light-gray body, red band, brown band	8.81in	multi-use tear gas
XM675 red smoke	light-green body, brown band	8.81in	multi-use smoke
XM1060 multipurpose	gold nose, OD body, green case	4.95in	thermobaric

THE M79

With development of the 40mm projectile progressing satisfactorily, work on possible launchers commenced during the early 1950s at Springfield Armory, MA. Proposed designs were identified by “S-” for “Springfield” with most never leaving the drawing board. One design was a shotgun-like break-open device for testing ballistics; this was not a portable weapon. Another was a shoulder-fired revolver design that was found to be too heavy and complex. The 40mm S-3 was based on the Federal Laboratories 37mm tear-gas gun as used by police departments. Its break-open design dated back to the 1930s. Several flare pistol-like designs were also examined.

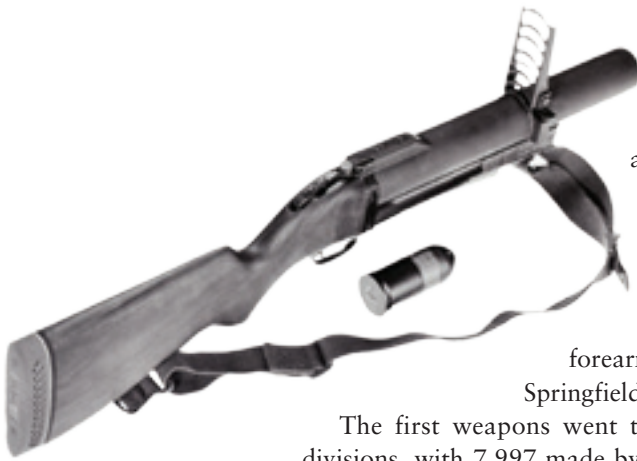
Dissatisfied with the prototypes, Lieutenant Colonel Roy E. Rayle, the Springfield Armory R&D chief, recommended the simplest design possible, the S-5, based on the Stevens Model 220 hammerless single-barrel shotgun. The S-5 borrowed much from the S-6 (T148), but every effort was made to achieve simplification. The result looked like a very large-bore sawed-off shotgun. Regardless of the goal of simplicity, it was criticized for being a single-shot weapon.

The S-5 became the XM79 in early 1959 after the T148 (S-6) project was canceled. The firing and receiver mechanisms and most of the small parts were of carbon steel for durability and phosphate-coated to reduce corrosion. The barrel was a special anodized impact-extruded aluminum with a hardened bore coating, making the S-5 the first weapon with an aluminum barrel. This was possible owing to the light firing pressure. Production drawings and manufacturing techniques were developed, and 12 XM79s were completed at Springfield Armory by June 1960 and shipped to Fort Benning, GA for further testing. The lattice or ladder-type rear sight was found to be inadequate, and the leaf-type adjustable “Buffington” style rear sight was accepted in October. (The nickname was derived from the Buffington sight used on the .50-70 Springfield M1884 trapdoor rifle, invented by Lieutenant Colonel Adelbert R. Buffington. The nickname fell from use after the M79 was standardized.) The decision to type-classify the XM79 was made on October 19, 1960 and publicly revealed. It became Standard A on December 15, 1960.

The endurance specifications called for a minimum of 1,000 rounds without malfunctions, which most of the test samples exceeded. There



An XM79 grenade launcher of 1960 with a ladder or lattice-type rear sight and the normal blade-type front sight. This type of folding rear sight was initially standardized, but replaced by the leaf-type adjustable “Buffington” style rear sight. The new sight was standardized just prior to standardization of the M79. (USNPS Photo, Springfield Armory National Historic Site, SPAR 2031-59)



A 1960 XM79 grenade launcher fitted with the ladder-type folding sight. The curved "rungs" are aligned with the top edge of the muzzle in lieu of a conventional blade-type front sight. This type of sight was also tested on the T148 grenade launcher and proved less accurate than more conventional sights. (USNPS Photo, Springfield Armory National Historic Site, SPAR 2020-59)

were very few bugs to work out of the new weapon (additional windage adjustment was found to be necessary and the change was made to the rear sight before series production commenced), and the M79 met the Ordnance Ready Date at the end of March 1961. Through 1961 different sights were tested and refinements made. Plastic stocks and forearms were tested, but wood was retained.

Springfield was to deliver 2,056 M79s by July 1961.

The first weapons went to the 101st Airborne and 4th Infantry divisions, with 7,997 made by Springfield during 1960–62. Contracted production was completed in December 1962, three months ahead of schedule owing to rushed production during the Cuban Missile Crisis. New production commenced and the rate increased as they were needed by US forces and involved Free World forces. A quadrant sight was unsuccessfully tested in 1963–64 along with various stock designs and materials. Technical responsibility (drawings, upgrades) for the M79 was transferred to Rock Island Arsenal, IL in 1966 as Springfield Armory was set to close.

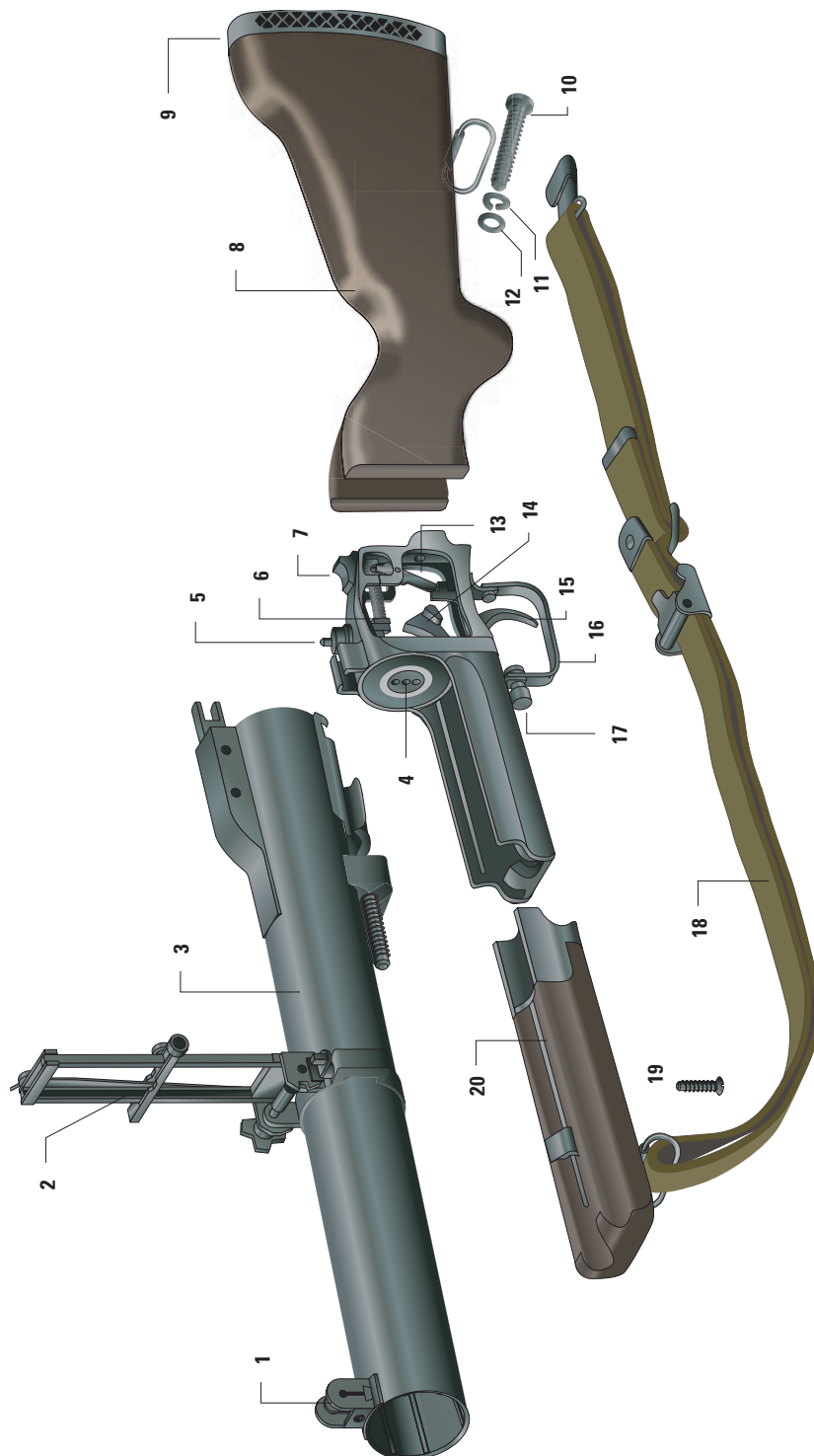
With the escalation of the Vietnam War, other manufacturers commenced M79 production: Action Manufacturing Co. of Philadelphia, PA; Exotic Metal Products Co. of Pasadena, CA; Kanarr Corp. of Kingston, PA; and Thompson-Ramo-Wooldridge (TRW Inc. from 1965) of Lyndhurst, OH. In 1966 an M79 cost US\$318 while an M16A1 cost US\$119 and an M14 US\$105. The Department of Defense began to shift weapons manufacture to civilian firms to achieve competitive prices, leaving R&D to government armories. There were complaints that specification standards were lowered to accommodate civilian production and some firms experienced startup delays. It appears it did not seriously affect production quality, however, and the delays were usually made up.

M79 series production ran during 1961–71, ceasing owing to the withdrawal of US and Free World forces from Vietnam and the pending adoption of the M203 UBGL. Approximately 350,000 M79s were US made, with many provided to friendly nations. An unpublicized number were stored in contingency stocks. M79 licensed production continued through the 1980s in South Korea as the KM79 by Daewoo Precision Industries Co. The Socialist Republic of Vietnam reverse-engineered and produced the *súng phóng lựu M79-VN* (grenade launcher M79-Vietnam) at the Precision Engineering Corp. Factory Z125 with an optical sight and a glossy plumb-red synthetic stock. Large numbers of M79s obtained from South Vietnam and Cambodia in the mid-1970s were degrading and Factory Z125 was tasked with refurbishing them.

M79s have been used by Australia, Brazil, Cambodia, Chad, Colombia, Costa Rica, Dominican Republic, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Great Britain, Greece, Guatemala, Haiti, Honduras, Indonesia, Iran, Ireland, Israel, Jamaica, Jordan, Kenya, Kurdistan

THE "THUMPER" REVEALED

40mm M79 grenade launcher



- | | | |
|---|--------------------------|----------------------------------|
| 1. Front sight | 8. Stock assembly | 15. Trigger |
| 2. Rear sight assembly | 9. Recoil pad | 16. Trigger guard |
| 3. Barrel group | 10. Screw | 17. Trigger guard release |
| 4. Firing pin | 11. Lock washer | 18. M1 web sling |
| 5. Barrel locking latch | 12. Washer | 19. Screw |
| 6. Receiver group and firing mechanism | 13. Cocking lever | 20. Forend assembly |
| 7. Safety | 14. Hammer | |

(Peshmerga), Lebanon, Malaysia, Myanmar (Burma), New Zealand, Nicaragua, Oman, Paraguay, Philippines, Portugal, St. Vincent and the Grenadines, Saudi Arabia, Somalia, South Korea, Spain, Taiwan, Thailand, Turkey, Vietnam, and Yemen. Small numbers are used by various police forces, security forces, and paramilitary organizations. M79s are highly valued by insurgents, guerrillas, crime cartels, and other lawless groups.

Given the capabilities the M79 offers, it is in fact comparatively light and compact; approximately 2lb lighter than an M14 and about the same as an M16A1. The barrel has six lands and grooves, right-hand twist, one turn in 48in. A latch atop the breech unlocks and opens the barrel. Any length of cartridge can be loaded. (The T148, XM148, China Lake, and M203 could not chamber longer rounds.) A thumb safety lever is positioned directly behind the latch. An M79 breaks down into the barrel group, receiver group with the firing mechanism, and stock and forearm assemblies. The single-stage trigger pull is 7.5–10lb (M14 rifle pull is 5.5–7.5lb). There are 68 parts (not counting the sight's 22), but the number having to be removed for cleaning are few and none is considered fragile.

The buttstock is unusual in that the bottom edge is straight, except for the pistol grip, aligned with the line of recoil. The top or comb is contoured to keep the grenadier's head upright owing to the line-of-sight relief when firing at low angles. There is a short walnut forearm.

The stock was originally black walnut or birch with a brown Pachmayr pad with a white spacer and seven T-shaped compression openings on each side for cushioning. Later pads lacked the white spacer. Still later pads on wooden stocks were dark-brown polyurethane-covered sponge rubber with no compression openings as dirt, mud, and snow-ice lodged in these. Owing to splitting and strain-cracks on wooden stocks, which were especially prone to warping on the forward end's thin wood extensions that fit on either side of the receiver, dark-brown solid fiberglass stocks were fitted on new-production M79s and as replacements for damaged stocks. Plastic stock production had begun in mid-1966 with a black recoil pad. A plastic forearm was developed, but never fielded, being deemed unnecessary. In Iraq and Afghanistan stocks and entire M79s have been painted sand-color and new sand-colored plastic stocks are available. They were seldom camouflaged with paint or green tape in Vietnam. The M79 was issued with a canvas small-arms accessory case, bore brush with thong, plastic oil tube, combination tool, and cleaning brush.

The front sight over the muzzle was a protected tapered blade of the same design as that of the M14, just slightly larger. The large forward-folding leaf-type rear sight was positioned about 5in aft of the front sight, this being necessary because of the high angles required for indirect fire. The range scale was graduated from 75m to 375m (82–410yd) at 25m increments and numbered at 100, 200, 300, and 375m, and was adjustable for windage. The rear sight was cammed to the left to compensate for the normal, but slight, right-hand drift of the projectile caused by the right-hand rifling twist.



An October 1961 photograph of Springfield Armory officials hosting Iranian Army officers examining XM79 grenade launchers. Many XM79s and early-production M79s had light-gray gunmetal barrels. (USNPS Photo, Springfield Armory National Historic Site, SPAR 1244-61)

Cut-down M79s

Since its formation in 1964, MACV-SOG reconnaissance teams (RTs) carried one or two grenade launchers. RT grenadiers also carried an M2 carbine or M16A1 rifle, and they hauled significant rucksack loads including their own radios. Because engagement ranges were typically short and firefights brief, some USSF carried an M79 as a supplementary “break-contact weapon.” To save weight and space, the shortened M79 evolved. It might be carried by “550 cord” around the neck, in a rigger-made canvas holster, canvas pocket sewn horizontally under a rucksack, or in modified radio accessories bags (CW-216A/PR for an AN/PRC-10 or CW-503/PRC for an AN/PRC-25/77) used as holsters. Only 6–12 rounds of HE and MP might be carried, sometimes a few CS.

The shortened M79 typically had the stock cut off leaving a pistol grip and 2–3.5in of the barrel sawed off along with the front sight. Only wooden stocks were sawed off, not plastic. Typically, 3.5in of the barrel was sawed off flush with the end of the forearm, but sometimes up to 1in of the forearm was cut off with an equal amount of the barrel. The rear sight was removed, but usually the sight bracket remained. Occasionally the stock was cut down to the pistol grip and the leaf sight removed, but the barrel was not shortened. Overall, a cut-down M79’s weight was reduced by 2–2.5lb and its length shortened by 13–14in.

A member of Company L (Ranger), 75th Infantry in Vietnam in 1970 reported he cut the barrel off 1in beyond the length of a 5.27in M583A1 illumination round. He removed the safety which would reset when closing the breech and had to be manually set on Fire. This increased the rate of fire.

The M79 gave RTs an edge not only because of its ability to launch HE rounds farther than hand grenades can be thrown, but because it offered a psychological advantage as many of the enemy were inexperienced rear service troops who presumed that the detonating HE

CUT-DOWN M79 MYTHS

Numerous myths surround the cut-down M79 based on various misconceptions or assumptions. The most common claim is that the recoil was too heavy for it to be practical. Some claimed the recoil was so severe that it would throw the GL out of the shooter's hands. While the recoil was indeed somewhat increased, it was wholly manageable, though smaller-statured soldiers (Asians or Latin Americans, for example) may have experienced some discomfort. The recoil was slightly harder with buckshot rounds, which was stiffer than HE cartridge recoil to begin with owing to the smaller high-pressure chamber; but since the cut-down M79 was an emergency-use weapon, it was not intended to fire numerous rounds. The muzzle blast was not significantly increased, nor was the negligible muzzle-flash amplified. Others claim that *only* buckshot rounds were used because of the HE cartridge's recoil, which is not true. Whether HE or buckshot was used was an individual preference. Some used only one or the other; most used both, depending on the situation.

It has also been suggested that the shortened barrel will not impart sufficient spin on the projectile to arm HE rounds. Typically 2–3.5in was cut off the 14in barrel resulting in a 10.5–12in barrel. 12.2in of the barrel is rifled. In fact, spin-armed rounds had no trouble arming. (As an aside, the M320 GL has an 8.46in barrel, the shortened M203 SOPMOD is 9in, and the

M32A1 an 8in barrel. The rifling only made about one-fifth of a full turn in these barrels.) Being a two-handed "pistol," aiming the cut-down M79 was difficult and required practice. One user reported being able to hit a 55-gallon drum repeatedly at 100m (109yd).

Another claim is that the weapon's range was drastically reduced, but there is no range loss with even 4in of the barrel removed. Regardless, range was not an issue: RTs stayed within dense vegetation and close terrain as much as possible and as the cut-down M79 was an immediate-response and break-contact weapon, range was not a concern. Engagements were seldom undertaken at ranges in excess of 30m (33yd), often much less, because at such ranges the HE round might not arm. Buckshot rounds were frequently used. CS rounds were sometimes fired directly at the enemy if at a range beyond that of CS and other hand grenades. Also, because at such short ranges the M79 could be aimed for direct line-of-sight shots, this enabled it to be fired through gaps in the vegetation. A hand grenade could only be thrown at an estimated arc with a high likelihood of being deflected by intervening vegetation. Since RTs traveled through dense, close terrain, there was a high probability of M79 rounds striking trees, limbs, or dense vegetation when fired at the enemy. The resulting air-burst increased the casualty radius.

This early-production M79 grenade launcher is fitted with the Pachmayr recoil pad with X-shaped compression openings. These attracted mud, ice, and snow and later production recoil pads were solid synthetic rubber. The impact-extruded aluminum barrel is anodized to a nearly olive drab color. Other M79s had dark gunmetal barrels. (USNPS Photo, Springfield Armory National Historic Site, SPAR 2383)

rounds were mortar or even artillery rounds. Some RTs, even though they possessed an XM148 or XM203, still carried a cut-down M79. In the 1980s the cut-down M79 saw some use by El Salvadorian troops operating in conjunction with USSF advisors.

In the mid-1980s it was decided that the RTs of the new long-range surveillance units (LRSUs) assigned to divisions and corps would not be provided an M203 as they were to conduct passive reconnaissance and avoid detection by the enemy. It was reasoned that if so armed they would be emboldened to undertake offensive action. This was utterly ridiculous: a six-man RT deep behind enemy lines is not disposed to aggressive mission-compromising direct action. However, if the RT is detected, the grenade launcher provides a significant edge and improves its ability to break contact.



M79 dead-end innovations

From 1962 to the end of the Vietnam War, the US Army Limited War Laboratory (USALWL) at Aberdeen Proving Ground developed a series of specialized counterinsurgency weapons. Several innovative efforts encompassed the M79; none was adopted.

A more effective means of grenadier self-defense was sought and the USALWL's solution, contracted to Olin Mathieson Chemical Corp. in 1964, was an insert 12-gauge, 6.25in shotgun barrel with a 40mm plastic sleeve that slipped into the M79's breech. It was to fire shotgun shells loaded with 27 No. 4 buckshot pellets. Only five were sent to Vietnam for testing and no results returned. The adapter proved to be impractical to load rapidly enough for immediate self-defense when a pistol sufficed; and the more practical 40mm buckshot round was under development.

The year 1965 saw the development of a reloadable adapter that could be inserted into the M79's chamber to volley-fire 18 .22 Long Rifle cartridges for self-defense. The project was transferred to Frankford Arsenal, PA and eventually dropped as the M576 buckshot round proved more effective and lighter.

USALWL attempted to formalize the cut-down M79 with the handheld GL kit. It was easy for the grenadier's hand to slip on the pistol grip, disengage the safety, and accidentally fire the weapon if a finger was on the trigger; but rather than cutting off the buttstock, it was removed in its entirety and replaced by a checkered aluminum pistol grip with a safety-protecting spur atop the grip. 3.5in of the barrel was cut off and the leaf sight removed. Kits were provided to 5th SF Group in 1970 for testing. However, by this time the M203 had been adopted, thus eliminating the need for the sawed-off M79.

In 1965 the USALWL developed adapters to mount the XM148 on M1 rifles and M1/M2 carbines for the ARVN. The M1 rifle version proved to be too cumbersome, however, as the GL's barrel extended 7in beyond the rifle's muzzle. Work on the rifle adapter was terminated, but that for the carbine version continued, although the GL's barrel extended 3in beyond the carbine's muzzle. Three of the carbine adapters were sent to Vietnam for testing, but by then the XM148 had been canceled, the ARVN was receiving the M16A1, and the XM203 was under development.

White phosphorus (WP) rounds were considered for target marking and breaking contact, but rejected. White phosphorus liquefies in high ambient temperatures, causing rounds to tumble and resulting in duds. If detonating at minimum arming range, burning WP particles could blow back on friendlies. Also, a bullet rupturing a WP projectile carried by a grenadier would immolate him.

The rocket-assisted XM1 launcher-propelled grapnel and XM688 launcher cartridge were developed for the M79 to enable the launch of a .31in-diameter, 400ft-long nylon rope 138ft high (75° elevation) or 230ft horizontally (45° elevation) to emplace a climbing or stream-crossing rope or deploy the grapnel across minefields to be dragged back to trigger tripwires. Testing revealed that the XM1 was too heavy for routine tactical use, and it could not be used in conjunction with the M203.

THE T148

Anticipating the need for a repeating grenade launcher for the new 40mm round, the T148 GL was developed by Springfield Armory from the S-6 prior to developing the XM79. The T148E1 was outwardly similar to the coming XM79, but was a magazine-fed repeater. The reasoning was that the single-shot XM79 could not deliver sufficient rates of fire, even with two squad grenadiers together firing 12rd/min. A three-round weapon could deliver more rounds faster with three rounds in the air before the first struck the target.

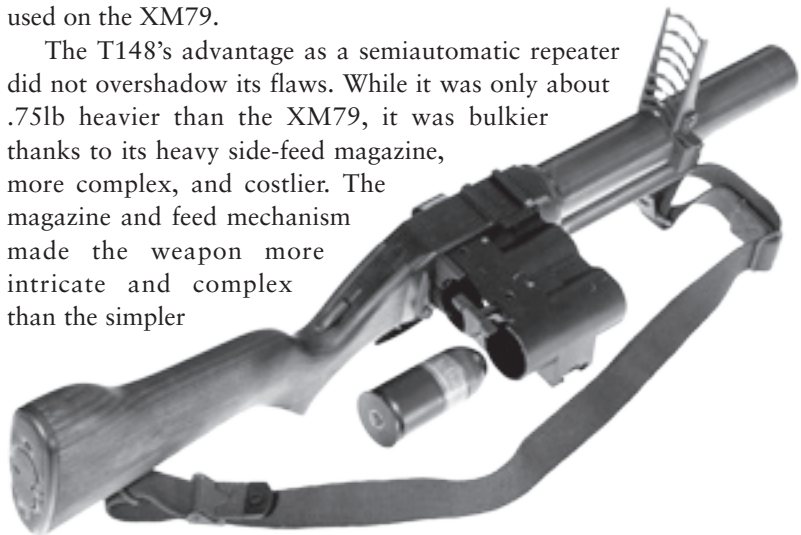
Design and engineering work was undertaken in late 1957 along with the preparation of technical data and the study of possible methods of manufacture. In early 1958, 200 pilot T148E1s were completed. However, it was decided to concentrate on the simpler and lower-cost XM79 and on July 1, 1960 the T148 project was terminated.

The T148 was composed of the receiver, trigger mechanism, magazine, and sight assemblies and the barrel and stock groups. The magazine had three open-ended horizontal cartridge tubes doubling as firing chambers with the feed mechanism on the underside. The safety was either on the right side or the upper rear of the receiver depending on the version. Pushed forward, it was set for Fire and rearward was Safe. Different types of stocks and sights were tested, most of which had the XM79's in-line-of-recoil stock with a recoil pad or a steel M14 rifle butt plate. Differences between the T148E1 and E2 involved different sights, stocks, forearms, butt plates, location of safety, etc.

A tangent-type sight with leveling bubble and graduated from 50m to 285m (55–312yd) was mounted on the top right of the magazine housing on early T148E1s. The weapon did not require a front sight; it was insufficiently accurate and adding a sight would have made it easier for the weapon to become snagged on vegetation. The quadrant sight lock was rotated counterclockwise one turn, the slide rotated to the desired range, and the range setting locked by rotating the lock clockwise. Most T148s were re-fitted with a folding lattice-type leaf sight as used on the XM79.

The T148's advantage as a semiautomatic repeater did not overshadow its flaws. While it was only about .75lb heavier than the XM79, it was bulkier thanks to its heavy side-feed magazine, more complex, and costlier. The magazine and feed mechanism made the weapon more intricate and complex than the simpler

T148 experimental grenade launchers varied with different sights, stocks, forearms, butt plates, location of safety, etc. They were made in small batches with different modifications. This particular T148E1 is fitted with a ladder-type folding sight negating the need for a front sight. It has the M14 rifle's steel butt plate and trapdoor for a cleaning kit. (USNPS Photo, Springfield Armory National Historic Site, SPAR 207-59)



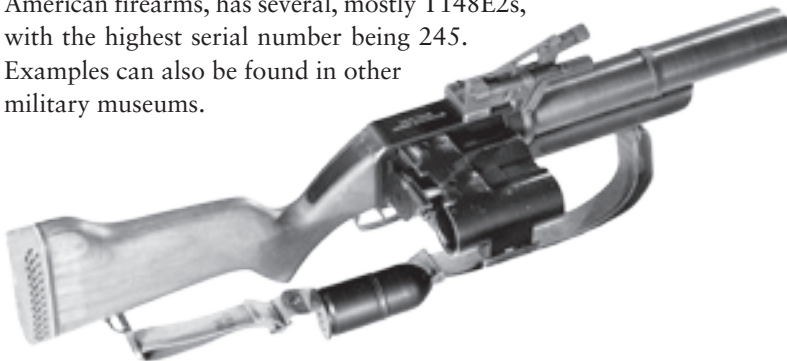


A view of the T148E1 repeating grenade launcher showing the three-round, right-side feed magazine in the ready-to-fire position. The magazine's three cartridge holders double as firing chambers. Note the larger than normal safety lever on the top back of the small of the stock and positioned lower than on the standardized M79. The grenade launcher's greenish anodized aluminum barrel is apparent. This version has a steel M14 rifle butt plate later replaced by a rubber recoil pad. (USNPS Photo, Springfield Armory National Historic Site, SPAR 2365)

XM79. The three-round “harmonica” side-feed magazine and magazine mechanism was heavy, having three cartridge chambers, and was prone to jamming with dirt, mud, snow, vegetation debris, etc. The sliding magazine could throw the weapon off balance. Its rate of fire, with additional magazines, was somewhat faster than the XM79; but if magazines had to be reloaded during action, the rate of fire was actually lower. Magazines were heavy and costly, limiting the number that could be carried. Gas leakage between the chambers and the barrel was the principal flaw. Another problem was that after some use, the alignment lever catch broke and jammed in a downward position, allowing the magazine to slip left without aligning the middle chamber and instead aligning the third chamber. The third chamber was duly fired, after which the middle chamber had to be manually aligned before the T148 could be fired again. The major problem with the T148 was the magazine's three chambers. The inconsistent leakage of gas between the frontends of the chambers interfacing with the breech resulted in erratic ranging. There were complaints of the weapon not handling as well as the M79 and that it was less accurate. Additionally, only rounds that were 4.95in or shorter in length could be fired, thus precluding the use of many special-purpose rounds.

There was little combat testing of the T148. Some were field tested by the 1st Cavalry Division in 1965 prior to deploying to Vietnam and a few were tested by USSF in Vietnam and even fewer by LRRP units. One was acquired by SEAL Team One, but was never used operationally, it being assessed that the magazine's open frontend would collect mud and vegetation debris. They were also tested by Special Forces at Fort Bragg, NC. The author fired a few rounds from one in 1968 while undergoing SF weapons training, finding it awkward.

It is not known how many T148s were produced. Springfield Armory National Historical Site, MA, the world's largest collection of American firearms, has several, mostly T148E2s, with the highest serial number being 245. Examples can also be found in other military museums.



Another version of the T148E1 GL with a complex quadrant sight, which proved too complex, flimsy, and snagged on vegetation. It has a commercial rubber recoil pad, which also was some use on early M79 GLs. The cartridge is an inert round. The OD web M1 small-arms sling was used on all T148s and initially on the M79. (USNPS Photo, Springfield Armory National Historic Site, SPAR 12762-SA)

Members of 1st Squadron (Air), 9th Cavalry, 1st Cavalry Division (Airmobile) – probably in Troop D (Ground Reconnaissance) – in 1965 prior to departing Fort Benning, GA for Vietnam. The unit field-tested T148 GLs, but they were not taken to Vietnam. A major complaint was how easily dirt, dust, mud, rainwater, and vegetation debris entered the forward ends of the magazine chambers. The second man from the left holds an M79 GL. (US Army)



THE XM148

Although the M79 was enthusiastically accepted, the main drawback was the reduction in the number of the squad's rifles its introduction entailed. This limited the number of point-fire weapons, and grenadiers had only a pistol for self-defense. Mounting a GL on a rifle would resolve both issues, and to this end the Grenade Launcher Attachment Development (GLAD) program commenced in 1963 with prototypes offered by different firms. The CGL-4 (Colt Grenade Launcher), designed by Karl R. Lewis and Robert E. Roy of Colt Manufacturing, Hartford, CT, was selected for development as the XM148 to be mounted on XM16E1 rifles and XM177E2 SMGs. Lewis wrote the specifications, designed the weapon, drew the plans, and built a working model in 47 days.

Twenty-five XM148s were delivered to the US Army and publicly announced in May 1964. After lengthy testing, limited production commenced in November 1966, with the first 1,764 examples shipped to Vietnam and issued in mid-January 1967. Selected infantry battalions exchanged their M79s for XM148s. Others went to MACV-SOG, SEALs, and the Australian Special Air Service (ASAS) plus 52 to the ARVN. (The ASAS mainly used XM148s on 5.56mm XM16E1 rifles, but a few were mounted on 7.62mm FN L1A1 rifles and 9mm Sterling L34A1 silenced SMGs.) The US Marine Corps did not use the XM148. While troops were initially enthusiastic, mainly because it gave grenadiers a rifle, flaws in the GL soon became evident. It was too fragile and there were safety concerns. In April 1967, the 199th Infantry Brigade requested an evaluation of the XM148 owing to the emerging problems. Five points were assessed:

- The effect the weapon had upon small-unit tactics.
- The performance of the weapon as intended under combat conditions.
- A determination of failure and maintenance issues, with an emphasis on failure rates for specific parts.
- A determination of whether the XM148 was desired by infantrymen as a replacement for the M79 grenade launcher.
- If adopted, a determination of what basic load would be appropriate for individual soldiers assigned to combat support and combat service support units.



The evaluation was conducted in 12 battalions and found that grenadiers welcomed the rifle and GL combination, but voiced complaints: the rate and accuracy of fire slightly decreased; engagement reaction time was slower; movement in vegetation was hampered owing to the sight snagging; and extraordinary cleaning and maintenance was required to keep the XM148 functional.

Design aspects attracting complaints included: difficulty in dismounting the XM148 from the host weapon for cleaning and repairs; loss of the small screws and locking pins; rusting screws; difficulty cleaning small parts; the pistol grip easily broke making the XM148 difficult to reload; and the precise sequence in which the sear lever had to be removed and reinstalled. Over three-quarters of the barrel was in direct contact with the barrel housing – 2.125in protruded from the housing – and infiltrating sand, dirt, mud, and lubricant and gunk made it difficult to slide the barrel.

There were 67 parts to the XM148 (not counting the sight's 23 parts; grenadiers were not permitted to disassemble sights), of which 45 were small and/or fragile. It was even recommended that disassembly be accomplished over a poncho or blanket with a buddy present to watch for dropped parts.

While the surveyed battalions operated on a variety of terrain and encountered different targets, the typical engagement ranges were: 67 percent reported between 50m and 150m (55–164yd), 11 percent under 50m, 20 percent between 150m and 300m (164–328yd), and 1 percent over 300m (owing to rounding, percentages do not total 100). The most common targets were concealed or suspected enemy positions, enemy in the open, bunkers, foxholes, huts, and sampans. Small-unit tactics were no different from those when using the M79 other than the increase of two rifles per squad.

The XM148's sight was difficult to use, marginally accurate, and prone to snagging, resulting in it often being removed. The trigger extension could be bent or broken when disassembling the host weapon. The GL's trigger could bind the trigger extension and prevent the weapon from cocking. The trigger could be immobilized by foreign objects caught between the host weapon's receiver and the GL's trigger. If the XM177E2 SMG's telescoping stock was not firmly latched, the stock could collapse when the XM148 was firing, slamming the sight into the firer's face. The cocking lever's 30lb pull was heavily criticized – using it was described as being like lifting 3.6 gallons of water with two fingers.

An XM148 UBGL mounted on an M16A1 rifle, courtesy of Trey Moore. The trigger extension rod can be seen extending from the rear of the GL, and over the right side of the magazine housing to be positioned near the host weapon's trigger. As can be seen the trigger extension rod could be easily damaged. The trigger-like cocking lever can be seen extending from the GL's breech between it and the magazine housing. The cocking lever rotated so is shown here hanging downward and is not fully visible.

(Author)



If a bayonet was attached it obstructed the XM148's muzzle. If the GL was fired the projectile tore off the bayonet without detonating. The GL could be carried with a chambered round, but should not have been cocked and the safety set until ready to fire. If the GL was loaded, cocked, set on Fire, and the trigger moved from the stowed to the firing position, it might discharge. If the exposed sear lever on the right rear of the barrel breech was pressed while the GL was cocked and loaded, it discharged. While considered a safety hazard and complained of, some users endorsed this as a means to fire off an immediate shot by aiming and pressing the left thumb against the sear lever. This procedure was officially discouraged, but it was also common practice. Issued with the XM148 were a canvas sight case, bore brush with thong, cleaning brush, combination tool, Allen hex wrench, and $\frac{7}{16}$ in open-end wrench.

In May 1967 the Army Concept Team declared the XM148 to be too fragile and unsafe. Colt attempted a redesign called the CGL-5, but it was no more than a refined XM148 that suffered the same shortcomings. The US Army turned in the XM148s in the fall and reissued M79s. The SEALs and ASAS retained theirs until units rotated home – operating in small teams, they preferred the imperfect rifle-mounted XM148 over returning to the M79. Most of the 34,000 XM148s were destroyed, but some went to military museums and 25 to Springfield Armory National Historical Site. None was provided to other countries.

The XM148 GL had a 10in barrel and an overall length of 16.5in. The additional 6.5in was the trigger system consisting of the trigger extension – a protruding rod curved to contour around the right side of the rifle's magazine well. Protruding from the GL's rear was the trigger-like cocking lever (early versions had a round cocking knob). The cast-aluminum barrel housing was mounted on the rifle's barrel using a half-round upper handguard. It could be mounted in minutes without the need for special



This XM148 under-barrel grenade launcher is fitted to an M16A1 rifle with its tangent sight above the grenade launcher's breech. The long tangent arm possessed integral front and rear sights, unlike the M203's sight which required a folding-leaf front sight. The cocking lever can be seen projecting from the breech. On the upper forward part of the grenade launcher's small pistol grip can be seen a small silver-colored wire fitting. This prevents the grenadier's left hand from being pinched when the barrel is slid forward for reloading. (USNPS Photo, Springfield Armory National Historic Site, SPAR 3298)

tools. A similar, but shorter handguard was necessary for the XM177E2. A stubby aluminum pistol grip was attached to the barrel below the breech. This had a release latch to slide the barrel forward for loading through a 4.5in opening, but the length of the opening precluded the use of longer special-purpose rounds. The tilting bar sight was attached to the launcher's left upper side. It was graduated from 50m to 400m (55–437yd) at 50m intervals with 100, 200, 300, and 400m marked by "1" to "4."

UBGL HOST WEAPONS AND THEIR KEY CHARACTERISTICS				
Weapon	Weapon weight without UBGL	Overall length	Barrel length	UBGL
5.56mm M16A1 rifle	6.35lb	30in	20in	XM148, M203
5.56mm M16A2/A3 rifle	7.78lb	39.62in	20in	M203, M320
5.56mm M16A4 rifle	7.50lb	39.62in	20in	M203, M320
5.56mm XM177E2 SMG	6.10lb	33in extended, 29.7in retracted	11.5in	XM148, M203
5.56mm M4/M4A1 carbine	6.36lb	33in extended, 29.75in retracted	14.5in	M203A1/2, M320A1
7.62mm Mk 17 Mod 0 rifle	7.90lb	38in extended, 28in retracted	16in	M203, Mk 13 Mod 0*
* The Mk 13 Mod 0 UBGL is an FN40GL Enhanced Grenade Launching Module (EGLM) seeing very limited use by SOCOM.				

THE CHINA LAKE MODEL

In 1967 the SEALs requested a 40mm repeating GL to supplement the single-shot M79. They were in need of a man-portable rapid-fire weapon

rather than a rifle-mounted single-shot GL, but the earlier three-shot T148E1 proved unacceptable. To meet the SEALs' need a new GL was developed in 1968 by Alfred F. Kermode of Naval Weapons Center, China Lake, CA, the US Navy's largest weapons test center. Sources differ as to how many were built, ranging from 16 to 50, the highest serial number. The US Navy had 22 on its books at one point, but probably had possessed more. The new GL was known simply as the "China Lake pump-action GL." It has been called the "EX41," but this designation refers to an entirely different GL developed at the Naval Ordnance Station, Louisville, KY in 1995. It was also incorrectly called the "China Lake NATIC," with "NATIC" having no known meaning.

The China Lake GL was a pump-action with a three-round, under-barrel, tubular magazine. A fourth round could be loaded in the chamber but, unknown to many, a fifth round could also be loaded on the elevator plate, which lifted rounds from the feedway to the chamber, behind the three rounds in the magazine. It used M79 fixed-blade front and leaf-type rear sights with a conventional shotgun-style wooden stock and rubber recoil pad. The safety lever was positioned behind the receiver atop the stock; the ejection port was on the upper right side; and the pump-action handgrip was stamped aluminum.

While heavier than other GLs – 8.2lb (about the same as an M14 rifle), 10.21lb loaded – the China Lake GL was popular owing to its rapid-fire ability, firing four rounds in 5–6 seconds – especially useful when ambushing sampans, attacking base camps, or laying suppressive fire. It could fire only 40mm rounds of the same length and profile as HE rounds, no pyrotechnic signals – short buckshot rounds jammed. Much use was made of aluminum to reduce weight, resulting in it being somewhat flimsy and prone to breakdown with hard use. SEAL detachments rotating out of Vietnam passed their China Lake GLs to relieving detachments, the Vietnam War being the only conflict in which it was employed. Four China Lake GLs are known to reside in museums, one being in Vietnam.

What was known simply as the China Lake grenade launcher was developed by Naval Weapons Center, China Lake, CA to meet a 1968 US Navy SEAL requirement for a repeating 40mm grenade launcher. No more than 50 were built and their use was limited to Vietnam until the SEALs departed at the end of 1971. The remaining operational weapons were retired. The somewhat bulky weapon held three rounds in the under-barrel tubular magazine plus one in the chamber and could hold a fifth round on the elevator plate that lifted rounds from the magazine to the chamber feedway. The China Lake GL used the same front and rear sights as the M79 GL. (CC BY 3.0/Remigiusz Wilk (REMOV))



THE M203

Regardless of the failure of the XM148, a UBGL was still sought. In the late 1950s and early 1960s the US Army undertook Project SALVO and the Special Purpose Individual Weapon (SPIW) programs to identify infantry weapons with increased lethality and rates of fire. The rifles were to be .17 to .22 caliber firing high-velocity bullets, flechettes, or duplex rounds (two stacked bullets). The ideal weapon would include a semiautomatic, three-round UBGL.

The prototypes were heavy, awkward, intricate, and fragile; but adoption of the M16A1, a lightweight, small-caliber, selective-fire rifle, negated further SPIW efforts. Attempts with multishot UBGLs failed dismally. One contending firm was AAI Corp., which had failed with its three-round UBGL on its SPIW offering. AAI's Advanced Combat Rifle could mount a 40mm under-barrel "area fire weapon" with a three-round "half-moon magazine." This was deemed too complex and heavy, and so they worked on a single-shot UBGL in 1966–67. This evolved into what would become the XM203.

In August 1967, 17 firms were solicited to develop new UBGLs under the GLAD program. Only seven expressed an interest with AAI, Philco-Ford Aeronautic Division, and Aerojet Ordnance making submissions. In May 1968, AAI and Philco-Ford each supplied 20 prototype UBGLs for extensive testing. The Aerojet offering was rejected, being a bulky three-round semiautomatic GL. The Philco-Ford submission was an overly complex single-shot weapon with a barrel that swung to either side for loading. The AAI design was deemed superior, but the sight was revised.

In August 1968 the AAI "pump launcher" was type-classified as the XM203 grenade launcher mounted on the M16A1 rifle and XM177E2 SMG. In December 1968 AAI was contracted to supply 600 XM203s for testing in Vietnam. Some 500 were issued to selected units in April 1969 as well as small numbers to MACV-SOG, SEALs, and the ASAS. The XM203 was found to meet expectations, being safe, simplistic, reliable, and rugged. The quadrant sight was recommended to be deleted, but it was retained. The XM203 was type-classified as Standard A as the M203 on August 29, 1969.

While AAI developed the M203, they did not have the capacity to produce the necessary numbers. Colt – which ironically had developed the ill-fated XM148 – produced the majority of M203s. (Most sources say AAI was not contracted, but it was in fact granted a contract for 10,000.) In the rush to field the weapon in Vietnam and Army-wide, it was not arctic-tested until 1971. When these cold-weather tests were eventually carried out, they revealed minor defects caused by ice and snow accumulation, but these were corrected on production M203s. Colt did not commence series production until 1971, so very few M203s saw use in Vietnam before the last infantry units withdrew in August 1972. M203s had replaced M79s in all US services by the mid-1970s. Now in use for approaching 50 years, the M203 has changed little during that time.

The M203, made largely of 7075 T6 aircraft aluminum, has approximately 72 parts including both sights. It consists of the barrel with handgrip, receiver with firing mechanism, quadrant sight attached to the



This M203 under-barrel grenade launcher is fitted to a 5.56mm M16A1 rifle with its distinctive special boxy handguard. The tangent sight can be seen on the carrying handle. The grenade launcher's folded leaf sight can be seen atop the handguard aft of the rifle's front sight. The barrel latch lever is between the handguard and the GL's barrel above the barrel's handgrip. (USNPS Photo, Springfield Armory National Historic Site, SPAR 3275)

host weapon's carrying handle, and a handguard with the leaf sight. A boxy handguard was used with the M16A1/A2/A3/A4, while the XM177E2 used the standard short upper handguard and special mounting bracket attached. The M203 is issued with the same accessories as the M79.

The XM177E2 SMG was withdrawn soon after the Vietnam War and M16A1 rifles remained in use into the 1990s. The M16A2 was fielded in 1989, the M16A3 in 1993 for the US Navy, and the M16A4 in 1999 for the US Army and US Marine Corps. The standard M203 can be mounted on all of these rifles, but not on the M4 carbine, introduced in 1989.

During the 1980s, modified versions of the M203 appeared to enable the UBGL to be mounted on other weapons. The first was the M203PI (Product Improved), produced in 1987 by RM Equipment, Inc. of Miami, FL. PI versions include a "Universal" model attachable to weapons with Picatinny rails (MIL-STD-1913) and also a "Snap-on Launcher System." The M203PI can be mounted on the H&K G36, H&K MP5, Steyr AUG, FN FAL, AK, and others.

The M203A1 is the same as the M203 with minor modifications for mounting on the M4 and M4A1 carbines, which require a shorter box-style handguard. The M203's muzzle reaches to about 1in short of the carbine's muzzle. The M203A2 was necessary for mounting on the M4 and M4A1 as well as the M16A2/A4 fitted with quick-release mounting brackets and the adapter rail systems (ARS), the M4 for carbines with a short half-round handguard, and the M5 RAS (Rail Adapter System) for the M16A2/A4 fielded in 2009. Early in the Iraq and Afghanistan wars, when US Marines were still mainly armed with M16A2/A4s, grenadiers usually had M4s mounting an M203A2 as the carbine weighed just over



11lb less than the rifle. While the M203 and M203A1 could be mounted with minimal armorer assistance, the RAS required an armorer to install the M203A2 mounting. Optional clip-on vertical forward-assist handgrips on the barrel handgrip were introduced in Afghanistan.

The shortened M203 SOPMOD is issued in the Special Operations Peculiar Modification kit, which was issued from 1993 to support four M4A1 carbines with a wide range of accessories and contained a shortened M203. The M203 SOPMOD has a 9in barrel – it is often claimed to be

FAR LEFT

An M203 UBGL attached to an XM177E2 submachine gun, aka “CAR-15,” “Colt Commando,” or “shorty 16,” a weapon mainly used by MACV-SOG from 1967, in this instance Reconnaissance Team Minnesota. The M203’s barrel reached almost to the muzzle of the host weapon’s flash suppressor. Note the special semicircular upper handguard and mounting bracket. The GL’s safety lever is raised in the safe position blocking the trigger. The 30-round magazine was extremely scarce until seeing general issue in the mid-1970s. Here two 30-round magazines are taped together for quick reload. (Tom Laemlein/Armor Plate Press)



LEFT

An 82d Airborne Division paratrooper with an M4A1 carbine fitted with an M203A1 UBGL checks out suspicious movement in an upper-story window. 40mm GLs have been proven as excellent UO (urban operations) weapons – the term UO replaced MQUT (military operations in urban terrain), but the latter remains in use. (US Army)



A US Navy Seabee (construction battalion engineer) undertakes practice firing in Afghanistan with an M4A1 carbine mounting a SOPMOD M203 UBGL. He is using the folding rear leaf sight and the carbine's front sight. The SOPMOD 9in barrel is about 3in short of the host weapon's muzzle while an M203A1/A2 with a 12in barrel would reach almost to the carbine's muzzle. Shortened SOPMOD M203s are often mistakenly identified as M203A1/A2s for mounting on M4 carbines. (US Navy)

An M203A1 fitted to a commercial M4 carbine, courtesy of Trey Moore. The Advanced Combat Optical Gunsight (ACOG) is fitted to a Picatinny rail atop the receiver – a “flat-top receiver.” The characteristic integral carrying handle on earlier M16s and M4s has been made a separate accessory that itself can be attached to tactical rails. When it was found that the carrying handle – integral or detachable – made for an inadequate sight mount, it was deleted altogether in the late 1990s. (Author)

an M203A1/A2, but is not, owing to confusion with the M203A1/A2 intended for carbine mounting. Related accessories include a quick-attach mount with leaf sight and an AN/PSQ-18A day/night sight. The AN/PSQ-18A has an infrared aiming laser and an integrated illumination laser allowing target acquisition and area illumination, plus mechanical features to provide rapid and precise firing. It fits on the left forward end of the M203's barrel, replacing the quadrant sight.

Two sights are available: the quadrant sight attached to the left side of the host weapon's carrying

handle with a front sight post; and rear sight apertures that can be folded down when not needed. The range quadrant is graduated from 50m to 400m (55–437yd) at 25m intervals and mainly used for targets over 200m (219yd). For closer or hastily engaged targets the leaf sight is used as a rear sight in conjunction with the rifle's front sight. The forward-folding leaf sight is near the forward end of the handguard. It is graduated from 50m to 250m (55–273yd) at 50m intervals, with 100m and 200m marked “1” and “2.” It can be further adjusted using 10m elevation adjustment marks.

American manufacturers of the M203 are: Colt; AAI; U.S. Ordnance at McCarran, NV; Airtronic USA in Elk Grove Village, IL; RM-Equipment Inc. of Miami, FL; Knights Armament Co. (KAC) in Titusville, FL; and Lewis Machine & Tool Co. (LMT) of Milan, IL. Contract unit costs vary from US\$840 to US\$1,050.

M203A1s are made by Colt Canada (Diemaco prior to 2005) in Kitchener, Ontario for use on C7 and C8 rifles, Canadian versions of the M16. The quadrant sight can be fitted on the barrel's right or left side rather than only on the carrying handle's left side. License-built M203s are made by: Al Maadi Co. for Engineering Industries in Egypt; Daewoo Precision Industries (today S&T Motiv Co.) in South Korea, as the K201 for the K2 assault rifle; Floro International Corp. in the Philippines, as the FIC M203; Mechanical and Chemical Industry Corp. (MERK) in Turkey,



COBRAY 37mm LAUNCHERS

Since the 1980s Cobray Co. LLD (Westhope, ND – originally Smyrna, GA) has marketed a line of M203-lookalike launchers for law enforcement use. They fire only 37mm tear gas, non-lethal, smoke, and flare cartridges and are marked “37MM LAUNCHER.” These are rated as non-destructive devices as the smoothbore barrels cannot be loaded with 40mm rounds. The several versions of the CM203 (originally designated CM2037) have minor differences from actual M203s including different safety levers, triggers, cocking levers, trigger guards, etc. They can be mounted under M16/AR15 rifles/carbines and are sometimes used as movie props in place of actual M203s, which require special permits for such use. In some states their use is restricted because they appear “intimidating” when attached to an M16 rifle using the M16/M203 handguard. Police seen armed with the CM203 have been assumed to have HE grenade-firing M203s. The CM79LF does not resemble an M79, but is a CM203 fitted with a pistol grip behind the trigger guard and a skeleton stock folding over the top of the barrel, making it a standalone GL.

as the T-40; and PT Pindad (Persero) in Indonesia, as the SPG-1. Several firms offer accessories and kits to enable M203s to be converted to standalone GLs.

The M203 has been used in every conflict involving US forces since Vietnam. It is used by Afghanistan, Albania, Argentina, Australia, Bangladesh, Brazil, Brunei, Cameroon, Canada, Czech Republic, Denmark, Dominican Republic, East Timor, Ecuador, Egypt, El Salvador, France, Gabon, Great Britain, Greece, Guatemala, Honduras, India, Indonesia, Iraq, Ireland, Israel, Italy, Jordan, Kuwait, Lebanon, Liberia, Malaysia, Mexico, Myanmar (Burma), Netherlands, New Zealand, Oman, Pakistan, Panama, Philippines, Qatar, Romania, Saudi Arabia, Singapore, South Korea, Sri Lanka, Sweden, Thailand, Turkey, United Arab Emirates, and probably others.

THE M320

In 2004 the US Army issued a requirement for a 40mm UBGL with better reliability, accuracy, ergonomics, and safety than the M203, plus the capability of being adaptable to a standalone GL. Rather than develop a



A German 5.56mm H&K G36A2 assault rifle fitted with an AG36 *Anbaugranatwerfer* (attached grenade launcher) from which the US M320 UBGL was developed in 2004 at Picatinny Arsenal. While very similar, many M320 and AG36 parts are not interchangeable. Note that the AG36 lacks the folding forward handgrip found on the M320. The AG36 designation indicates that it is used in conjunction with the G36 rifle. The rifle mounts a Zeiss RSA-S reflex sight. (Kris from Germany)

new weapon, an “off-the-shelf” design would be selected. There were few suitable weapons on the market, however, and it was obvious that the requirement was for the German AG36 *Anbaugranatwerfer* (attached grenade launcher), designed for Heckler & Koch’s 5.56mm G36 rifle.

In the late 1960s Heckler & Koch GmbH in Oberndorf am Neckar developed the under-barrel HK69 Granatpistole (GraPi) to mount on the 7.62mm G3A3 rifle, and which was adopted in 1972. It was decided to develop the HK69 further as a standalone GL: the HK69A1, introduced in 1979. The later HK76 GraPi was mounted on H&K G3, G41, and HK33 rifles. These were rather simple GLs and in the early 2000s H&K commenced work on an advanced GL that could be used as a UBGL or standalone GL. The AG36, which is of a totally different design than the earlier grenade pistols, entered German service in 2006 and is used by eight other countries.

While based on the AG36, the M320 is a different weapon and some parts are not interchangeable. Both weapons are made of aircraft-quality aluminum and polymers. Initial development of the XM320 commenced in 2004 at Picatinny Arsenal working closely with H&K Defense of Ashburn, VA. Extensive testing was conducted by numerous test centers before H&K Defense commenced production of the M320 in the United States. The AN/PSQ-18A laser day/night sight (DNS) designed specifically for the M320 is produced by Insight Technology, Inc. of Londonderry, NH. The XM320 is also compatible with handheld laser rangefinders and night-vision goggles.

The first contract for 11,000 XM320s was let in May 2005. The M320 and M320A1 were standardized on November 6, 2008 after which production commenced, with initial deliveries made in February 2009. Issue to 1st Brigade Combat Team, 82d Airborne Division was in July 2009, just before deploying to Afghanistan. The M320 quickly proved extremely popular in Afghanistan and Iraq with its near-first-round hit probability. The M320 is used by the US Army and SOCOM, but not the US Marine Corps, US Navy, or US Air Force. Some were provided to the Philippine Marines. A total of 71,600 M320s and M320A1s have been ordered and it superseded the M203 in 2016, although some M203s may remain in use at least to 2020.

This 5.56mm M4 carbine mounts an M320 GL module with an Insight Technology, Inc. AN/PSQ-18A laser day/night sight designed specifically for the M320. The backup leaf sight is folded down here. Note the small hook-like fitting immediately below the muzzle. This prevented a finger holding the handgrip from slipping in front of the 40mm muzzle. This feature is not provided on production M320s. (US Army)





A 40mm M320 GL module in the standalone GL configuration; the collapsing buttstock is extended and is completely removed when attached to a host weapon. The small ring just forward of the butt plate is a sling contact point. Forward sling points are found on both sides near the muzzle. Some users complain the forward handgrip is too flimsy and unnecessary. Being attached to a Picatinny rail, it can be removed. (US Army)

The M320 can be mounted on any M16 rifle; the M320A1 has a different mounting bracket for M4 carbines. The M320 can be also mounted on the FN-made Special Operations Forces Combat Assault Rifle-Light (5.56mm SCAR-L, Mk 16 Mod 0) and -Heavy (7.62mm SCAR-H, Mk 17 Mod 0) adopted in 2004 (the SCAR-L Mk 16 Mod 0 was withdrawn from service in 2010). It has a double-action firing mechanism. If a round misfires, the grenadier does not have to wait 30 seconds, re-cock the weapon, and fire again as with an M203. He can immediately pull the trigger and it might fire. The M320 has an ambidextrous safety, selected as one of the Ten Greatest [Army] Inventions for 2009.

The M320 consists of a receiver frame with integral pistol grip containing the swingout barrel, firing mechanism, and controls. The barrel pivots to the left side, allowing longer special-purpose rounds to be loaded, there being no restriction on cartridge length as with earlier UBGLs. The forward-folding handgrip is only used when the M320 is configured as a standalone GL and is not found on the AG36. On the left rear of the launcher are the safety or selector lever, remote cable switch (interfacing with the DNS), buttstock locking lever (when attached), and a slot for a 3mm (.118in) hexagonal key wrench and 5mm (.197in) ends for installing/removing accessories and adjusting the leaf sight). The barrel-release button is within the upper forward end of the trigger guard. A slot on top accepts the collapsing buttstock when used. The DNS, mounted on the left side near the muzzle, has an integral adjustable front sight and a folding rear sight for direct-fire iron sights. When used, the folding leaf sight is slotted into the top of the DNS or on the frame without the DNS. A mounting bracket is on

A paratrooper of the 1st Brigade Combat Team, 82d Airborne Division poses with an M320A1 GL module configured in the standalone mode during 2009 pre-deployment training for Afghanistan. This was the first combat use of the M320. The leaf sight assembly is folded so he is actually not aiming. (US Army)



the right side as an alternate fitting for the leaf sight with its own front sight. The leaf sight is graduated and marked from 50m to 350m (55–383yd) at 50m intervals.

The M320 is more complex than the M203, but offers a number of beneficial features. The AN/PSQ-18A DNS provides a liquid crystal display showing the range readout, cant light warning if the weapon is tilted too much for accurate aiming, battery status, mode selector, infrared target area illumination, and a 400m (437yd) laser rangefinder adjustable to 5m (16.5ft). It uses a commercial 3-volt DL123A lithium battery. Unit price for the M320 is US\$3,500.

The GL is attached to the host weapon after removing the lower adapter rail or handguard, seating the rear adapter pins in the barrel nut's teeth spaces and the forward quick-release lever locks on the bayonet lug. To use the M320 as a standalone GL, once detached from the host weapon the buttstock arm with recoil pad is slid into the slot atop the M320 and latched, the release being on the left side. It can be set in four length positions.

Attaching and detaching the M320 from the host weapon is an involved process not easily accomplished in the field. Normally, a weapon is configured one way or the other and used in that configuration for an operation's duration. Individuals have their own preferences for a given configuration, with some preferring weapon-mounted for stability and accuracy or because the detached buttstock is awkward, while others feel the standalone M320 is handier. Those carrying a detached M320 retain an M4 carbine. When the M320 is dismounted, users often complain about the amount of swing when it is sling-carried. A holster was recommended in surveys; three makes were field-tested in 2013 with the preference selected in 2014, but this has yet to be announced. In the meantime, some soldiers have purchased commercial holsters. Some feel the buttstock design is awkward and the somewhat flimsy folding handgrip unnecessary.

THE M32A1

This revolver-type MGL was developed by Milkor (Pty) Ltd. in Pretoria, South Africa, the firm having been established in 1980 by the weapon's designer, Andries C. Piek. The 40mm MGL was developed in 1980–81, demonstrated to the South African Defence Force in 1981, and after extensive testing, adopted as the Y2 in 1983. The MGL's variants are internationally marketed by Armscor (Armaments Corporation of South Africa). Overseas sales of the Milkor were limited owing to the UN's arms embargo on South Africa, voluntary from 1963 and mandatory from 1977 until lifted in 1998.

This semiautomatic six-shot revolver, shoulder-fired MGL is a very different weapon to single-shot standalone GLs. Lessons learned from around the world resulted in an improved version in 1996, the MGL Mk 1 being more reliable and easier to operate and maintain. In 2004 the product-improved Mk 1S (Stainless Steel) was made available, replacing the steel frame with stainless steel and featuring a simplified trigger group. Picatinny rails on the forearm were introduced after they were added to US-made M32s, but its 105mm (4.1in) cylinder was unable to accept longer special-purpose cartridges.

The Mk 1L (Long), aka MGL-140, soon followed. It incorporated the same improvements as the Mk 1S (Short), but with a 140mm (5.5in) cylinder enabling it to fire longer special-purpose cartridges. A new frame and cylinder replaced the earlier marks; all had telescoping buttstocks. Milkor also introduced the 37/38mm Multiple Anti-Riot (MAR) Yima gun (*Yima* = "Hold-up/Stop" in Zulu) capable of firing the slightly smaller-caliber tear-gas and less-than-lethal cartridges.

During the Second Battle of Fallujah in late 2004, US Marines identified a need for a compact man-portable weapon able to fire HE grenades at multiple, rapidly emerging targets. In the middle of the next year the US Marine Corps Systems Command at Quantico, VA asked prospective manufacturers to deliver five "Commercial Off The Shelf" weapons within two months. Only Milkor USA Inc. in Tucson, AZ – a separate firm from Milkor Ltd. – responded and in August 2005 was contracted for 210 MGL-140s, a developmental process normally taking 3–5 years. Subcomponents are made by a subcontractor, Abrams Airborne Manufacturing Inc. in Tucson, AZ. The test weapons were South African-made, but the US Marine Corps insisted on American-made weapons. The Marine version, designated the M32, was fitted with Picatinny rails and an M2A1 reflex sight with an infrared capability and powered by an AAA battery. The sight allows for rapid range and elevation adjustments, compensates for the projectile's right-hand drift, and is compatible with night-vision goggles. The M32s were delivered in October 2005 and underwent extensive, but rushed testing to include combat trials

A 1st Marine Division gunnery sergeant sights an M32 MGL through its M2A1 day/night reflex sight. Here the M32 is configured for direct fire. Picatinny tactical rails are fitted to the top and sides of the handguard along with a short rail on the underside for the adjustable forward handgrip. The bracket on the forward end of the right upper partition of the handguard is a sling attachment point. Another is on the left upper portion of the handguard. The M32's lengthy 11.8in barrel is apparent when compared to the 8in barrel of the M32A1 and Mk 14 Mod 0. The J-shaped release fitting in the center of the cylinder's front plate both releases the cylinder and activates the case extractors. His M4 carbine is slung on his left side. (US Marine Corps)



in Iraq beginning in March 2006. It is said that the US Marine Corps contracting officer bestowed the designation “M32” as his unit had been 3d Battalion, 2d Marines.

Working closely with Milkor USA, improvements were made by SOCOM in 2008, resulting in the Mk 14 Mod 0 MGL (not to be confused with the SOCOM 7.62mm Mk 14-series Enhanced Battle Rifles); 230 were delivered in 2009 and more have probably been acquired. Differences between the M32 and Mk 14 Mod 0 are minor. The most noticeable include the Mk 14 Mod 0’s 8in barrel and shorter handguard as opposed to the M32’s 11.8in barrel. Minor refinements include a redesigned pistol grip, quick-detachable forward handgrip, a revised barrel attachment method, and the trigger mechanism.

Fielding of the M32A1 (a minor modification of the Mk 14 Mod 0) began in 2008–09 with 2,191 going to all US Marine Corps infantry and reconnaissance units, not just those engaged in combat. Purchase options allow for some 3,000 more to be acquired. The M32A1 does not replace the rifle squads’ three M203s. From January 2011 it has been a discretionary weapon with 27 authorized to each battalion and allocated as necessary. The grenadier – who may be a rifleman or fire-team leader, as all infantrymen are trained on the M32A1 – retains his M4 carbine. A loaded M32A1 weighs 18.4lb whereas an unloaded M249 SAW is 17lb, 22lb loaded, but few troops complain owing to the weapon’s value.

While more formal training on the M32A1 – to include mechanical and maintenance, target engagement, firing positions, and sighting – is provided, an untrained Marine can be given five minutes’ instruction on how to load, sight, and operate an M32A1 followed by firing 24 rounds at different targets and ranges. Owing to its rapid firing and fast reloading, the M32A1 has proved more effective than the M203. One technique is to fire a single round, track the round, observe its impact, make range and deflection adjustments, and rapid-fire the remaining rounds in a matter of seconds. Within 250m (273yd) of a building a grenadier can rapidly pump rounds through several windows. An experienced grenadier can fire six rounds in three seconds before the first reaches the target to distribute them evenly in a box measuring 20m×60m (22yd×66yd) at ranges of up to 375m (410yd). Soft-skin vehicles are easily disabled by a burst. If the first round is a near-miss, a second and third can be fired immediately

before the target reacts. Scattered moving enemy personnel can be easily engaged with multiple rounds. The M32A1 has proved effective against suspected roadside IEDs and other pinpoint targets to 125m (137yd). A mix of rounds can be loaded in the cylinder and manually advanced to the necessary type of round.

The Milkor USA MGL is of a totally different design than previous 40mm GLs and is available in tan, green, and black. Regardless of the base color, the barrel, pistol grip, buttstock tube, and other

A grenadier of the 1st Battalion, 24th Marines (USMC Reserve attached to the 1st Marine Division) loads an M406 HE round into the No. 3 chamber of an M32A1 MGL with the shorter 8in barrel. The semicircular wind arrow can be seen on the “star extractor” in the cylinder’s center. 40mm grenade pockets can be seen on the Marine’s ILBE. A 40mm grenade bandoleer is visible on the ground to the cylinder’s right. (US Marine Corps)





A licensed copy of the Milkor six-round multishot GL as manufactured by Military Industry of Colombia (INDUMIL) as the MGL Mk 1 grenade launcher. It is seeing limited use with the Colombian National Army and has been exported. (MAURICIO DUENAS/AFP/Getty Images)

fittings are black. The US Marine Corps and SOCOM order only tan, though some M32s were green. Accessories include a padded nylon transport bag and cleaning kit with two-piece cleaning rod, tip, two bore brushes, cleaning brush, and oiler.

The barrel and receiver group holds the revolver cylinder and includes a protective frontend cover to prevent mud, dirt, dust, rain, snow, and vegetation debris from entering the chambers, and to protect the grenadier's foremost hand from escaping gases. Chamber numbers appear twice on the cylinder's forward rim. In the center of the protector is a J-shaped cylinder-release handle that also activates the six-point "star" extractor. The top shaft is a steel tube with the sight mounting rail. Aft of the cylinder frame is the trigger group with a large trigger guard that swings out of the way when the grenadier is wearing gloves. Behind the guard is an M16-style pistol grip with an ambidextrous safety above it. The telescoping tubular buttstock is attached above the forward end of the trigger group below the aft end of the top shaft. The recoil-padded stock with cheek rest can be raised to one of three positions. The higher the angle of fire, the higher the butt is raised to keep the buttstock as horizontal as possible. The barrel is fitted with a well-ventilated polymer handguard with four integral Picatinny rails. A handgrip is fitted to a rail near the guard's frontend. An M2A1 reflex sight is fitted to the support tube with a Picatinny rail. The sight is graduated from 0m to 375m (0–410yd) at 25m increments and numbered at 0, 50, 100, 150, 200, 250, 300, 350, and 375m.

Some 50,000 Milkor MGLs are used by a number of countries – Bangladesh, Brazil, Bulgaria, Colombia, Croatia, Denmark, Georgia, India, Indonesia, Malaysia (M32), Pakistan, Philippines, South Africa, South Korea (M32A1), Sweden, Taiwan, Thailand, Turkey, and Vietnam – usually as special-purpose weapons or by special units. They are additionally license-manufactured by Arsenal AD in Bulgaria which manufactures the Arsenal MSGL, similar to the Milkor. In South Africa, Rippel Effect Systems Ltd. (formerly Milkor Marketing Inc., but no longer part of Milkor) produces the XRGL40.

THE Mk 18, Mk 20, AND XM174

Three MGLs were developed during the Vietnam War for use in conjunction with high-velocity 40×53mm rounds. They were mainly used aboard US riverine craft (Mk 19) and helicopter gunships (M75, M129). In late 1962 the Aeronautical Products Division of Honeywell Corp., Hopkins, MN began development of a manually operated weapon for the low-velocity 40×46mm round. The M79 GL had only recently been adopted and Honeywell anticipated the need for a full-automatic weapon. The result was an unconventional, cumbersome-looking 26lb weapon, the **Mk 18 Mod 0** – the first and last manually hand-operated weapon since the Gatling gun was officially declared obsolete in 1915, the last having being procured in 1911. It had a 12in barrel protruding from a 6×12×18in boxy receiver, pistol grip in the back, folding ring and blade sights, feed port and ammunition box attachment on the left side, and the firing crank on the right. A three-position control knob on the receiver's rear allowed it to be set on Safe, Load, and Fire. It used a rotary split breech allowing straight-through feed, thus eliminating the need for a reciprocating bolt. Fired cases were reinserted in the black Mylar®-reinforced Dracon® belt. Two rounds were fired with each full rotation of the crank, chambering in the 3 and 9 o'clock positions and firing at 6 and 12 o'clock. The gunner simply turned the crank to vary the rate of fire from one shot up to 250rd/min. Short bursts were normal. Some 1,200 Mk 18 Mod 0s were built during 1965–68. The US Navy purchased 531 to piggyback-mount on .50-caliber M2 machine guns on the fantail of 31ft river patrol boats (PBRs), which also carried an M79, and two on 56ft armored troop carriers. The US Army procured 20 for testing, with a few mounted on M151A1 jeeps for base security patrols. Since engagement ranges were close on rivers and canals, the Mk 18 Mod 0 “hand-cranked grenade launcher” was ideal for shoreline

suppressive fire. They were sometimes mounted on other riverine craft and some were used by the SEALs on M2 tripods for .30-caliber M1919A4 machine guns. A 35lb 48-round ammunition box was used on watercraft and a 19lb 24-round box for ground firing. Belts were issued empty and hand-loaded to be reused four or five times. The Mk 18 Mod 0 and other grenade machine guns were replaced by the high-velocity Mk 19 Mod 3 after the Vietnam War.

The **Mk 20 Mod 0** machine gun was developed by Naval Ordnance Station, Louisville, KY. Looking more like a “machine-gun” than the Mk 18 Mod 0 did, it was 27in long with a 12in barrel and weighed 26lb. When cocked and ready to fire, the barrel protruded forward of the barrel housing. Clear, the barrel was retracted into the housing. It had left-hand feed, folding front and rear leaf sights, a cocking handle on top of the receiver, and spade grips. The Mk 20 Mod 0 was blowback-operated, offered semi- and full-automatic, and pumped out 250–275rd/min. It used the disintegrating metallic link belt of the high-velocity Mk 19 Mod 0 and the 24-round ammunition box. It was mounted on the 24ft light SEAL support craft.

The US Army's **XM174** automatic GL was developed by the Aerojet Ordnance Manufacturing Co. in 1968 and tested by the US Army, US Marine Corps, and US Air Force. This short recoil-operated weapon was based on the Browning .30-caliber M1919A4 LMG, weighed 16lb, and was 28in long. The gun used a 12-round drum and could fire at 350rd/min in short full-automatic bursts or semiautomatically. It could be mounted on the M2 tripod or vehicle pedestal mounts. The 284 XM174 and XM174E1 GLs saw limited testing in Vietnam, their widest use being with US Air Force security police in perimeter positions and XM704 security vehicles (V100 armored cars).



A 40mm XM174 low-velocity MGL with a 12-round drum magazine and mounted on an M2 tripod. (Tom Laemlein/Armor Plate Press)



USE

The “Thumper” goes to war

THE TACTICAL EMPLOYMENT OF GRENADE LAUNCHERS

40mm GLs are effective weapons up to 200m (219yd) for point targets and 375m (410yd) for area targets. They provide the rifle squad and platoon with a valuable, flexible, agilely moved fire-support weapon in offensive and defensive operations against a wide variety of targets as well as signaling and marking.

Manning and allocation

Since 1961 the US Army has allotted two grenadier-manned GLs to rifle squads, thus providing one grenadier for each of the two fire teams with the rank of specialist 4 (equivalent to corporal). During the M79's development it was considered that the two sergeant fire-team leaders be armed with M79s instead of M14s. Fortunately, it was decided that team leaders had too much to do in addition to operating an M79, and dedicated grenadiers were designated. From 1958 to the present day, US Army rifle squads have consisted of 9–11 men: the staff sergeant squad leader and two four or five-man fire teams (Alpha, Bravo).

Since 1944, the US Marine Corps has employed a rifle squad with three corporal-led, four-man fire teams (Nos 1, 2, and 3) plus the sergeant squad leader. When the M79 was fielded in 1962 a 14th Marine, a lance corporal (equivalent to Army PFC) grenadier, was added to the squad. One GL per fire team was desired, but the Marines were not willing to lose three of the squad's 13 rifles. When the M203 was fielded in 1972, the 14th man was deleted and the three fire-team leaders armed with M203s, the logic being that they would mark targets with the GLs. In many units, however, a rifleman in each team became a grenadier as team leaders were busy enough.

Owing to the XM148 UBGL's many flaws it only saw approximately nine months' service during 1967 with selected units in Vietnam. It is seldom seen in period photographs. The XM148s were withdrawn and M79s returned to the units prior to the February 1968 Tet Offensive. Here, an XM148 is attached to an M16A1 rifle using the special upper handguard. The L-shaped cocking lever can be seen forward of the 20-round magazine. The tilting bar sight has been removed here from the rear left side of the barrel above the GL's pistol grip, a common practice. (US Army)



In both the US Army and the US Marine Corps, grenadiers were armed with an M79 and a .45-caliber Colt M1911A1 pistol with three seven-round magazines. (11B (US Army) and 0311 (USMC) were the military occupation specialties for infantrymen in general. There is no specific code for grenadiers; they are infantrymen with specialty GL training.) It was not uncommon for grenadiers to carry an M16A1 rifle in lieu of the pistol to increase the squad's firepower. Some did not carry a pistol and others carried both a rifle and pistol. There were situations and terrain in which the grenadier could not always effectively or necessarily employ the GL, but the pistol was strictly a last-resort personal-defense weapon contributing nothing to the squad's offensive firepower. M16-armed grenadiers would carry fewer magazines than riflemen. As squads were generally understrength, the Marine squad's grenadier was part of a fire team rather than being a separate grenadier. Also, grenadiers with the M203 or M320 UBGLs carry fewer rifle/carbine magazines as the grenadier's shoulder weapon is secondary. Even with an arming/safe range of 14–17m (46–56ft), grenadiers know they can fire an HE round or other types against personnel at closer ranges with devastating effect without the round detonating. Buckshot rounds were developed for this purpose. Of course, the comparatively slow rate of fire makes this impractical for self-defense in anything other than emergency circumstances.

OPPOSITE

A squad grenadier of the 3d Marines, 3d Marine Division on Hill 861 northwest of Khe Sanh Combat Base in April 1967, before the epic battle commenced in which Hill 861 served as an important outpost for the main base. Until the rifle-mounted M203 grenade launcher was fielded in 1972, the US Marine Corps had only one grenadier per squad. With the introduction of the M203, the Marines went to three grenadiers per squad. In his left hand he holds a 3.5in M28A2 HEAT rocket for a 3.5in M20A1B1 rocket launcher or bazooka. (Bettmann)

Grenade launchers and squad automatic weapons

Since World War I most of the world's rifle squads have had at least one light machine gun, a concept introduced by the French. From the end of the Korean War the US Army has had two LMGs per squad and the US Marine Corps three since 1944. With the fielding of the M14 rifle in



1959, the M1918A2 BAR was replaced by the M14 “automatic rifle,” a standard M14 with a bipod and the selector lock removed. It performed poorly and so the US Army fielded the M14E2 in 1963; this was redesignated M14A1 in 1966. In spite of its modifications, however, it too was a poor automatic rifle owing to inaccuracy, overheating, and limited feed capacity. The US Marine Corps did not adopt the M14A1. With the fielding of the 5.56mm M16A1 rifle through the mid-1960s, first in Vietnam and then Army- and Corps-wide, there was no LMG. Rifle platoons relied on their two 7.62mm M60 machine guns for automatic fire support up to 800–1,000m (875–1,094yd). Some units grouped one or two GLs with each M60 as a fire-support team.

A “statement of need” for a squad LMG was released in 1972, and the 5.56mm M249 SAW began to be fielded in the mid-1980s and into the 1990s. The Army allotted two per squad and the Marines three. The Marines partly replaced the M249 with the Heckler & Koch HK416-based 5.56mm M27 Infantry Automatic Rifle beginning in 2011. The Army retained the M249, two to a squad, and replaced the two M203s with M320s.



An ARVN Ranger on the outskirts of Saigon in 1968. Many Vietnamese made very effective grenadiers. The Ranger next to the grenadier is armed with a 7.62mm M14A1 (formerly M14E2) automatic rifle while the rest of the troops have M16A1 rifles. The ARVN received very few M14A1s. (Tom Laemlein/Armor Plate Press)

M79 NICKNAMES

The M79 grenade launcher received numerous nicknames in Vietnam, as stated by one anonymous soldier in 1968:

They made a “Thump” sound when you dropped a round in the chamber.

They made a “Thump” sound a little distance away from them when you shot them.

They only “Thumped” your shoulder when you shot them with very little recoil.

And they sure as heck “Thumped” whatever you shot with them pretty good enough!

The Americans gave it nicknames relating to its distinctive report, a faint pop: “blooper” or “bluper,” “bloop tube,” or “blocker.” “Thumper” and “thump gun” were derived from its firing report and distant impact. “Burp-gun” (again for the sound, not because of any similarity with the M3A1 SMG), “elephant gun,” and “chucker” were less used. The cut-down M79 was simply called a “shortened (or short) M79” or “sawed-off M79.” Today, still in limited use by SOF, it is called a “pirate gun,” especially by SEALs, its nickname derived from the short, bell-mouthed blunderbuss or the swivel gun – a small, stubby cannon mounted on ships’ rails to repel boarders.

The projectile – “blooper ball,” “egg,” or “golf ball” – traveling downrange in a low arc looked like a 1.68in-diameter golf ball and traveled at about the same speed. The muzzle velocity of a 40mm HE round is 247ft/sec. Golf association governing bodies rule the velocity of golf balls will not exceed 250ft/sec, but most ball flights are slower.

Once standardized it was called the “M-Seventy-Nine” or simply the “Seventy-Nine,” but rarely as the “Mike-Seven-Niner” using the military communications phonetic letter and number pronunciation, though the cartridges might be call “40 Mike-Mike.” A media publicity tag called it the “platoon or

squad leader’s artillery.” “Blooper” might also refer to the grenadier himself as would a “bloop gunner,” i.e. one who “ran a blooper” (or other M79 nickname).

Australians tagged the M79 according to its short-barreled shotgun appearance: “shottie” (shotgun), “sawnoff” (sawed-off shotgun), or “wombat gun.” The latter nickname might be because of the M79’s stubby rotund appearance not unlike this slow-moving, docile marsupial. (“WOMBAT” was also the nickname of the British 120mm L6 recoilless rifle used by Australia – “Weapon Of Magnesium, Battalion, Anti-Tank.”) The British Army made limited use of the M79 in Northern Ireland and the Falklands and some units called it a “dunk gun,” because of the firing report, or “spud gun” owing to the projectile looking like a hand-thrown potato. The British also used baton ammunition, aka “rubber bullets,” and referred to M79s in this role as “baton guns.” Post-Vietnam, New Zealanders called grenadiers “headhunters,” their tactical hand signal for grenadiers being a fist with fore- and little fingers extended.

The Vietnamese formally refer to the M79 as the *súng phóng lựu M79-VN* (grenade launcher M79-Vietnam), simply the *súng M79* (launcher or rifle M79), or *Em bảy chín* (M-seventy-nine). In Spanish-speaking countries it is known as *la escopeta lanzagranadas M79* (the shotgun grenade launcher M79) or simply as *em-setenta y nueve* (M-seventy-nine).

The M203 and M320 GLs lack imaginative nicknames, being known simply as the “M-Two-Oh-Three” and “M-Three-Twenty” – the “M” might be dropped. However, the M203, M320, and M32 have on rare occasions been called “thumpers.” The M32 Multiple Grenade Launcher is occasionally referred to as the “M-G-L” and less so as the “Milkor” after the South African developer. It is occasionally referred to as the “six-pack” (mainly by the media) owing to its six-round cylinder. The SOCOM version is simply the “Mark 14.”

The pairing of GLs and the SAWs in the rifle squad provides a wider selection in terms of fire-support capabilities. In Vietnam when the Marines had only one GL in the squad, if engaging a small element, two fire teams and the grenadier laid down a base of fire while a third fire team maneuvered against a flank. The LMGs are realistically effective at 600–800m (656–875yd) against point and small area targets. Their ability to maintain sustained fire depends on their feed, 20- and 30-round magazines being inadequate compared to belt-fed. The GLs provide HE direct fire at point targets from within hand-grenade range (30–40m; 33–44yd) to 150m (164yd), and indirect fire against area targets up to

A US Marine Corps M14 automatic rifleman marks targets for the squad's grenadier. Conversely, the automatic rifleman could engage any enemy flushed out by exploding grenades. Marine Corps platoons were somewhat handicapped, having only three M79s compared to the US Army's six. With the introduction of the M203 immediately after the Vietnam War, the Marine Corps tripled the number of grenade launchers in their rifle and reconnaissance platoons, going from three to nine. (US Marine Corps)



375m (410yd). Seldom does a squad need to engage more distant targets. It is roughly calculated that the squad's two or three GLs provide one-third of its firepower, its two or three LMGs another third, and the 5–7

SEAL ambush, Vietnam 1970 (opposite)

The US Navy SEALs in Vietnam deployed on approximately six-month temporary duty tours. SEAL teams ONE and TWO deployed up to five 12-man platoons, each with two six-man squads. They conducted short-duration reconnaissance, hit-and-run raids, intelligence collection, and ambush missions using platoons and squads. Weaponry was left largely up to individuals, but the squad or platoon leaders could direct specific weapons be taken dependent on the mission. The terrain, expected ranges, and types of targets also dictated the armament. Attacking a small Local Force VC base camp with “spider holes” and bunkers called for different weapons than when executing a canal ambush against a sampan. The SEAL to the right is armed with a China Lake pump-action grenade launcher that could be loaded with 3–5 rounds, although four rounds was common. It weighed slightly over 8lb empty, about the same as an M14 rifle. The multiple-shot grenade launcher was valued for its rapid-fire ability to lob four aimed rounds in 5–6 seconds – especially valuable when attacking wooden sampans exposed on canals and rivers. A 40mm HE round striking water instantaneously detonated with most of the blast reflected from the surface and most fragmentation blown outward. A near-miss on a sampan was devastating. Owing to the China Lake's slide-action it was easy for mud, water, and

vegetation debris to enter the action and firing mechanism. This, coupled with its inherent fragility, made the weapon vulnerable to jamming and breakdown. The China Lake being non-standard, spare parts were not available and some of the few weapons available were cannibalized for parts. SEAL platoons rotating out of Vietnam transferred their China Lake GLs to the relieving platoons. Besides 40mm bandoleers, ammunition pouches, canteen covers, and Claymore bags, the SEALs used the grenade-carrying vest with 24 grenade pockets from late 1968. The back closure with adjustable tie-tapes securing the ventilating nylon-mesh back panels is obvious. The M79 grenade launcher (right) was used alongside the China Lake (left) owing to the M79's reliability and slightly better accuracy at longer ranges. The M79 grenadier carries a non-standard .45-caliber MAC-10 submachine gun with 30-round magazine. Grenade launchers were used in conjunction with automatic weapons with good results. The SEALs also favored the 5.56mm Stoner 63A Commando light machine gun, known to the US Navy as the Mk 23 Mod 0. It was popular owing to its various types of belt-fed, large-capacity magazines (here a 150-round belt drum) and light empty weight of 12lb, almost half the weight of the 7.62mm M60, which the SEALs also used because of its longer range and better penetration.



A US Marine assigned to 3d Battalion, 3d Marines, 3d Marine Division on Okinawa fires an M16A2 with an M203 UBGL and using his rucksack as a support. In the background a 5.56mm M249 light machine gun is fired from its bipod. M203s and M249s are often paired in fire teams to work together. (US Marine Corps)



rifles/carbines the other third from pointblank to 550m (601yd) – 400–450m (437–492yd) being more realistic.

GLs are issued to other units, with most headquarters and support units having a small number for self-defense. In a four-company (three companies prior to 1967) US infantry battalion in Vietnam there were 72 GLs in the 36 rifle squads, another one in each company HQ, and a half-dozen or so in both the battalion headquarters and company support companies.

Squad grenade-launcher tactics and techniques

Squad tactics and techniques are similar regardless of the GL models, although the improved accuracy of laser rangefinders and the rapid multishot capability of the M32 have resulted in more flexible use.

The first tactics manual incorporating the M79 was FM 7-15, *Rifle Platoon and Squads, Infantry, Airborne, and Mechanized* (March 1965). Other than training exercises, there were no real opportunities for lessons learned and new techniques to evolve. Units deploying to Vietnam had not even received the manual. There was barely mention of grenadiers in regards to control, suitable targets, positioning within movement formations, or incorporation into fire plans. In movement formation diagrams, grenadiers were shown in no particular position. Over the years lessons were learned and techniques developed along with new types of ammunition to expand the GL's value. Squad leaders handle most of the controlling. Fire-team leaders lead by example: when he advances the team advances, when he hits the ground and opens fire so does his team.

The FM 7-15 manual did provide the following guidance, which still applies:

The squad leader assigned the exact firing position and sectors of fire for the grenadiers, if not previously selected by the platoon leader. The sector should be the squad sector or large enough to overlap the sectors of adjacent grenadiers. The GL is used as a direct fire weapon at ranges up

to 350 meters [383yd] against crew-served weapons and grouped personnel. Grenadiers will cover the areas of dead space in the final protective fires of other weapons (MGs [machine guns], ARs [assault rifles]) and engage other appropriate targets.

For the most effective control, most team leaders position grenadiers adjacent to them to direct their fire whether moving or static. It was learned that a grenadier should not be a pointman. If hit it may be difficult to recover the GL under fire. In column formation the foremost grenadier, at least two men from the point, covers the front and one flank while the rearmost covers the other flank and rear. If engaged from a flank, both grenadiers return fire. Small patrols with one grenadier might position him near the rear to fire over the patrol as the lead men withdraw during a break-contact immediate-action drill. In assault line formations the grenadiers are usually positioned adjacent to the team leader. Team leaders are normally collocated in an automatic-weapon or GL position, whichever covers the most likely avenue of enemy approach, and their teams are assigned a sector of fire.

However, it is more important for the GLs to be positioned where both can cover as much of the squad's sector as possible and overlap fires with adjacent squads. Squads on platoon flanks will cover gaps between adjacent platoons with GLs and LMGs.

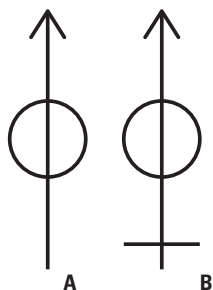
GLs can be employed to cover dead spaces with indirect fire that cannot be placed under line-of-sight observation or direct small-arms fire. This requires an experienced "blooper gunner." The GLs are pre-registered



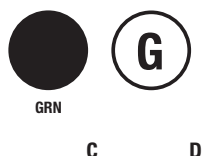
Wearing a DH-132A combat vehicle crewman's helmet, this M113A1 armored personnel carrier driver of 1st Brigade, 5th Infantry Division (Mechanized) prepares to fire an M79 GL at about as steep an angle as safely possible, though highly inaccurate. He is probably dropping rounds into brush-covered areas to flush out any ambushers concealed in the Rome-plow cleared area bordering both sides of a highway – reconnaissance by fire. (Tom Laemlein/Armor Plate Press)



This M79-armed grenadier of the 1st Infantry Division near the Saigon River in 1966 has as a secondary weapon in the form of a 12-gauge pump-action riot shotgun. Various models were issued with 20in barrels and five- or six-round tubular magazines. Most production M79 barrels had an OD-shaded anodized finish. (Tom Laemlein/Armor Plate Press)



Blue or black (for friendly) tactical map symbols for 40mm UBGLs or standalone GLs are comprised of an arrow (indicating a direct-fire small arm) augmented by a circle to indicate a UBGL or standalone GL (A). A 40mm machine gun uses the same symbol with the addition of a short horizontal bar partway between the circle and the lower end of the bar (B). Grenadiers are indicated in tactical movement formation diagrams by a solid dot with "GRN" below it (C) or a circle-enclosed "G" (D).



In Vietnam, platoon leaders sometimes concentrated three to six grenadiers into temporary teams to provide covering fire for maneuvering riflemen or to suppress suspected enemy positions. They were especially effective against non-positively identified sniper positions. Here four grenadiers of 2d Battalion, 35th Infantry, 4th Infantry Division lay down suppressive fire with M79s in 1967. (Tom Laemlein/Armor Plate Press)

to fire on specific targets and aiming stakes are set for night aim at these targets. Likely concealed avenues of approach for the enemy can be rigged with surface trip flares or trip-wired Claymore mines ("mousetraps") and when activated pre-planned GLs can fire into the area.

Turning to matters of control, initially, the GL was considered just another individual weapon. It was not until experiencing combat that it was learned the grenadier may not detect all suitable targets. Leaders and other squad members should alert him to targets. The team leader or squad leader can direct the grenadier as to which targets to engage and might use the GL to mark targets for the rest of the squad with HE or smoke. Grenadiers, though, do not wait for orders to fire. They immediately engage targets they detect.

Squad leaders can task organize as necessary, one example being a maneuver element of riflemen and a fire-support element with one or two LMGs and two grenadiers. In Vietnam some platoon leaders grouped 4–6 grenadiers into temporary teams to lay down suppressive fire, blast suspected positions, and engage snipers.

Ambush and reconnaissance: GLs make poor ambush-initiation weapons. If ambushing vehicles, engine noise may muffle the firing signature. Ambushers should not have to wait for the GL round's impact as a signal to open fire. GLs are effective ambush weapons because of their ability to deliver HE rounds at ranges greater than that of a hand grenade, and can pursue fleeing enemy with fire. GLs can also be used for reconnaissance by fire, i.e., firing on suspected enemy positions to invoke return fire or cause them to withdraw.



Urban combat: The M79's first urban combat in Santo Domingo, Dominican Republic taught valuable lessons that had never reached the training manuals. The 82d Airborne Division found that HE rounds detonated outside of window coverings (glass, shutters, louvers, Venetian blinds, screens, wire mesh, heavy curtains) and that little blast and fragmentation entered the room. Unless an enemy soldier was very close to the window, he would often escape injury. The round's detonation simply alerted the enemy to depart immediately. When an enemy's presence was detected, a squad's two grenadiers immediately aimed at the window. One was designated to fire first and the second to fire immediately upon hearing the first's "thump." The first round blew away window coverings and the second entered the room through the opening to detonate inside against a wall or ceiling. HEDP rounds will penetrate any common window covering and blow some blast and secondary fragmentation into the room in a narrow cone, but most fragmentation will be expended outside and what little penetrates will only cause casualties directly in its narrow path. Using GLs within buildings and fortifications is ill-advised owing to fragments penetrating interior walls and blast reflecting down hallways, but mainly because the 14–27m (46–89ft) arming range makes it impractical within close quarters. The buckshot round can be used to shatter door hinges and for self-defense.

US Marines in Operation *Enduring Freedom* (overleaf)

The US Marine Corps adopted the M203 UBGL at the end of the Vietnam War with one assigned to each of a rifle squad's three fire teams (Nos 1, 2, and 3). The M203 has been mounted on the M16A1, M16A2, and M16A4 rifles and the M4 and M4A1 carbines by the Corps. Today the 13-man Marine rifle and divisional reconnaissance squads are armed with ten M4 carbines, three M249 light machine guns and/or M27 Infantry Automatic Rifles, and three M203A1 UBGLs, and can be augmented by one or two M32A1 MGLs, making it arguably the most heavily armed rifle squad in the world. While the US Army began replacing the M203 UBGL in 2009 with the more sophisticated M320 GLM (see pages 64–65), the Corps is retaining the proven reliable, simpler, and lower costing M203. This M203A1 mounted on an M4 carbine has a clip-on forward handgrip. The squad with three M203 GLs can pump out approximately 18 aimed 40mm rounds per minute and maintain that rate of fire for several minutes. That rate could be doubled by the augmentation of the six-round M32A1. Of course it is seldom the case that such a high rate of fire is necessary. The benefit of having squad members armed with GLs is that they can immediately engage rapidly emerging targets such as fighting positions,

window firing positions, crew-served weapons, suspected enemy positions, and small groups of exposed troops without having to request and coordinate fire support from 83mm Mk 153 Mod 1 Shoulder-launched Multipurpose Assault Weapons (SMAW) or 60mm M224 mortars. The Marines fielded a small number of M32 MGLs in 2006 for combat testing in Afghanistan and Iraq. Deemed successful and adding a great deal of firepower to the squad, the M32A1 – shorter-barreled (8in), but achieving the same range as the longer-barreled (11.8in) M32 – was adopted in 2008. A slightly modified version of the M32A1, the Mk 14 Mod 0 MGL, was adopted by US SOCOM for use by Special Forces, Rangers, SEALs, Air Force Special Operations, and other SOF in 2009. SOCOM has the authority to requisition its own weapons, but that does not mean all component organizations necessarily use those weapons and may use others. 40mm rounds are carried on MOLLE and ILBE by "velcroing" one- and two-grenade pockets onto the web equipment in the numbers desired by the grenadier. Deeper two-round pockets are available for pyrotechnic rounds. Six-round bandoleers in which the cartridges are issued are also used and can be seen on the ground.





SHUMATE
2017

US 40mm GRENADE LAUNCHER CHARACTERISTICS					
Model	Empty weight ¹	Overall length	Barrel length	Ammunition capacity	Rate of fire
M79 GL	5.95lb	28.78in	14in	1	6rd/min
M79 cut-down GL ²	4–4.5lb	21.5–23in	10.5–12in	1	6rd/min
T148E1 GL	6.72lb	29.5in	12in	3	6–9rd/min
XM148 UBGL	3lb	16.5in	10in	1	5rd/min
China Lake GL	8.2lb	34.4in	14in	3–5 ³	15rd/min
M203 UBGL ⁴	3lb	15in	12in	1	5–7rd/min
M203 SOPMOD	2.47lb	12.7in	9in	1	5–7rd/min
M320 UBGL ⁵	5lb ⁶	11.18in	8.46in	1	5–7rd/min
M320 standalone ⁵	7lb ⁶	19.69in extended, 14.37in retracted	8.46in	1	5–7rd/min
M32 MGL	15.2lb ⁷	32in extended, 28in retracted	11.8in	6	18–21rd/min (6 rounds in 3 seconds)
M32A1 MGL ⁸	15.4lb ⁷	29.1in extended, 25.5in retracted	8in	6	18–21rd/min (6 rounds in 3 seconds)
GP-34 UBGL ⁹	3.1lb	12.4in	4.7in	1	5–6rd/min

1. For loaded weight add .5lb. For the three-round XM148 UBGLs add 1.5lb. Add 2lb to the China Lake GL with three rounds in the magazine and one in the chamber. Add 3lb to the six-round M32 MGL. Exact weight varies according to type of ammunition.

2. Cut-down M79 characteristics vary individually.

3. Dependent upon whether three rounds in magazine, one in feedway, and one in chamber.

4. Includes M203A1, A2, and PI.

5. Includes M320A1.

6. With AN/PSQ-18A day/night sight (.96lb).

7. With M2A1 reflex sight (1lb on M32, 1.18lb on M32A1/Mk 14).

8. Mk 14 Mod 0 has same characteristics as M32A1.

9. Russian 40mm muzzle-loaded GP-34 UBGL mounted on AK assault rifles for comparison.

A broken-open M79 GL, courtesy of Trey Moore. This photo reveals the foot-like ejector protruding from the lower portion of the barrel's breech, the breech lock on top of the barrel, and the curved cocking lever below the barrel's breech end. (Author)



FIRING GRENADE LAUNCHERS

While the ammunition is the same and there are similarities between the different types, each model of GL has its own particularities and peculiarities.

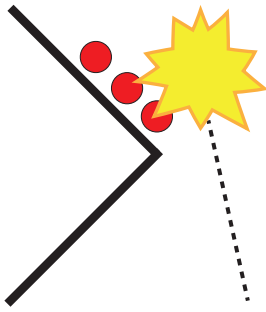
GLs can be fired from the usual firing positions, some being more accommodating than others owing to the GL's configuration, especially UBGLs because of the host weapon's design. These positions include standing, kneeling, sitting, squatting, prone, and supported. The latter includes leaning against a support like a building wall, fence, tree, or the lip of a foxhole. In Iraq and Afghanistan, firing from moving vehicles is taught. Most GLs can be fired from the right or left shoulder, although the China Lake was best fired from the right owing to the ejection port's location and the M320 from the right as the barrel pivots left for reloading. The recoil is moderate (the heavier the host weapon, the lighter the recoil) and is merely a sharp shove against the shoulder.



A US Army captain demonstrates loading an XM674 tear-gas (CS) cartridge (light-gray body) into an M79. The red band indicates CS (tear gas) and a light-brown band a low-velocity expelling charge. Almost 9in long, the cartridge cannot be loaded into XM148 and M203 GLs. There was also a similar XM675 red smoke cartridge (light-green body) employed for training in the use of the CS cartridge. A special four-cartridge bandoleer lies on the ground. (Tom Laemlein/Armor Plate Press)

M79 GL operation is extremely simple. It points nicely and naturally. The safety lever is slid back setting it on Safe. If wearing gloves or trigger-finger mittens, the trigger guard may be swung left or right by pressing a detent on the guard's frontend. The barrel latch forward of the safety is pushed to the right, automatically setting it on Safe if not already set. The barrel is broken open by pulling down the forearm. A cartridge is chambered and the barrel closed by pushing up on the forearm. Alternatively, holding the stock's pistol grip in one hand and with the other hand free of the forearm, the barrel can be closed by quickly snapping the wrist upward. Either way the barrel latch automatically locks.

To sight the M79, the range is visibly estimated and is set raising or lowering the bar by turning the elevation screw wheel. For close-range direct fire the leaf sight is in the folded-down position. The butt is placed firmly high on the shoulder. For mid-range fire at higher angles the butt is placed low in the hollow of the shoulder. For long-range indirect fire the butt is clamped under the arm. The rear-sight notch, front-sight blade, and the target are aligned. Indirect fire is also achieved by the grenadier kneeling with the GL's butt on the ground and range estimated by sensing and bracketing the target without using the sight. The safety lever is pushed forward to Fire, the weapon sighted, and the trigger firmly squeezed. The



When enemy troops are under cover behind a building corner they may be successfully engaged by firing 40mm rounds to impact at a point on the ground approximately 2–4m (7–13ft) past the building corner. This allows the round to detonate beside or behind the hidden enemy. However, be aware that firing a GL at this low of an angle may not always cause the round to detonate – graze effect low-angle impact. It may ricochet and either detonate farther downrange or not at all. If the first round fails to detonate, the grenadier should be prepared to fire subsequent rounds. It is more effective to simultaneously fire two GLs in this case. Regardless, 2–4 rounds should be fired to ensure sufficient casualties are inflicted.

OPPOSITE

US Marines undertake practice firing with an M203A1 UBGL on an M4A1 carbine fitted with quick-release mounting brackets and the adapter rail system (ARS). The grenadier is aiming with the aid of the GL's raised leaf sight and the rifle's front sight. The 40mm barrel is fully forward, providing a 5in opening capable of loading most standard cartridges. (US Marine Corps)

grenadier needs to keep his thumb away from the safety lever to prevent it being cut by the recoil. Recoil is slightly more than the M14's – 21.5ft/lb – and not uncomfortable. Opening the barrel, the spent cartridge is withdrawn 5in by the extractor and hand-plucked out of the chamber.

After removing the T148 GL's three-chamber magazine, the rounds were inserted in the chambers and pressed forward until the extractors latched. The cartridges' rotating bands held the indexing levers down. Set on Safe, a loaded magazine was inserted from the right and pushed in until the left chamber aligned with the barrel. It was set on Fire, aimed, and the trigger squeezed. Fired, the magazine automatically indexed left to the center chamber as the spent cartridge's rotating band no longer held the lever down and it was now ready to fire. All three rounds having been fired, the magazine was ejected to the left, the extractor releases depressed individually to remove the spent cases, and the magazine reloaded.

The XM148 UBGL was more involved to operate than the M79. To load, the barrel-release lever on the back of the pistol grip was depressed and the barrel slid forward – ensuring one's finger was not pinched between the pistol grip and the forward end of the feed port opening in the bottom of the barrel housing. A cartridge was inserted through the barrel housing feed port into the chamber to engage the cartridge retainer. The safety assembly below the breech was set on Safe (moved left), the trigger extension was pulled to the rear, and the cocking lever pulled. The pistol grip was slid back until the barrel-release latch locked. The trigger was rotated to its firing position and the safety set on Fire (moved right). The weapon was aimed and the trigger gently pulled. After firing the safety was set on Safe, the barrel release depressed, the barrel slid forward to eject the spent cartridge, and the weapon reloaded. There were complaints of the XM148 not handling as well nor as accurately as the M79, a criticism of all UBGLs.

The China Lake GL operated much like a Mossberg Model 500 and similar pump-action shotguns. With the weapon on Safe (lever rearward – Safe, forward – Fire) and the pump handgrip rearward (bolt open), three rounds were loaded into the tubular magazine through the bottom feedway port. A fourth round was hand-chambered through the ejection port and a fifth round could be inserted through the ejection port atop the elevator plate, which was pressed down sufficiently to allow the bolt to clear that round when the pump handgrip was racked forward. The safety was moved to Fire, the weapon aimed in the same way as the M79, and the double-action trigger squeezed. Recoil was light. Racking the pump handgrip back ejected the spent case and the elevator plate positioned the next round to align with the chamber. Racking the handgrip forward chambered the round.

To load the M203 UBGL, the barrel-release latch – located midway along the handguard's lower left edge – is depressed with the left thumb and the barrel slid forward by shoving the barrel handgrip. A cartridge is inserted through the 5in opening into the breech, the barrel slid rearward until it locks with an audible click, and the weapon is cocked. The safety lever, which cannot be set until the weapon is cocked, is in the forward end of the trigger guard; it is set on Safe by flipping it rearward toward



An M203 UBGL mounted on an M16A1 rifle being loaded with an M781 training practice round – light-blue shatterable plastic projectile and white plastic case. The round generates a puff of orange smoke. Care must be taken with a loosened sling to prevent it interfering with opening, loading, and closing the GL. (US Air Force)

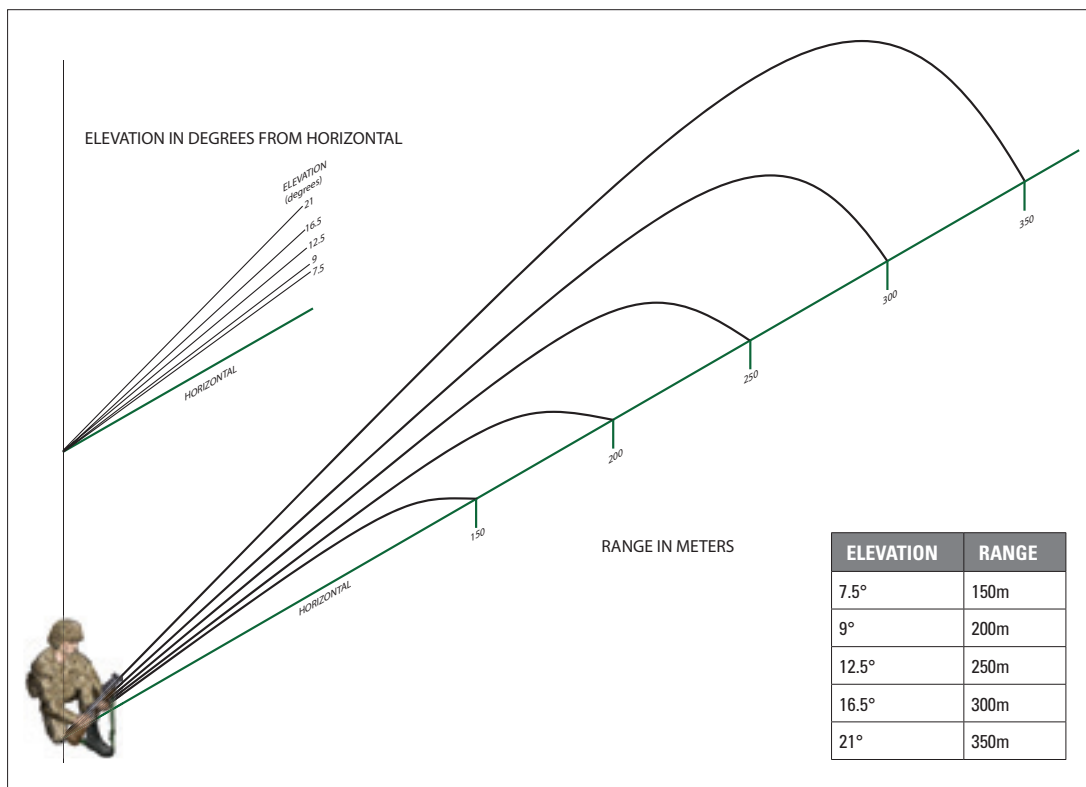


the trigger, which, besides locking the GL, obstructs the finger from gripping the trigger. When firing with a quadrant sight the butt is placed against the shoulder and with the leaf sight the butt is clamped between the underarm and torso. The safety is pushed forward to Fire, the target sighted, and the trigger squeezed. To unload, the barrel latch is pressed, the barrel slid forward, and the expended cartridge will be caught by an extractor on the face of the firing mechanism and fall off. If the grenadier is firing while wearing gloves, the trigger guard can be unclipped at its rear end and pivoted forward. The trigger is single-action, meaning that if a round misfires, the grenadier must wait 30 seconds before opening the barrel, re-cocking, and attempting to fire again.

The 5in breech opening allows most cartridges to be fired, but smoke parachute, smoke streamer, and other special-purpose rounds cannot be conventionally loaded. However, the barrel can be removed by pushing the barrel latch and sliding the barrel forward until it hits the barrel stop. On the left side of the handguard, the grenadier must insert a cleaning rod into the fourth hole from the muzzle, depress the barrel stop, slide the barrel forward and off, chamber a lengthy cartridge, and slide the barrel back on until it latches. It has to be removed again to unload – time-consuming, but useful if necessary.

To operate the M320 UBGL, first a systems check is conducted to clear the host weapon and the GL. The grenadier must rotate the selector lever from Safe to Fire and back to Safe, then attempt to pull the trigger, press the barrel release and pivot the barrel outward – ensuring the firing pin is not protruding from the bolt face – set the selector lever on Fire, and press the barrel release while trying to pull the trigger; the hammer should not release.

To load, the grenadier must point the muzzle in a safe direction, set the selector lever on Safe, remove the muzzle cap (it is seldom fitted in combat and would harmlessly blow off if fired), press the barrel release, pivot the barrel, load a cartridge ensuring it is fully seated, and pivot the barrel back into the receiver locking it with an audible click. The GL should be carried in the closed locked position with the selector on Safe.



To fire the M320, the range is determined by the DNS's laser rangefinder, a handheld rangefinder, or estimated. The grenadier should ensure the sling hangs to the right side of the weapon or it may interfere with loading the barrel. The grenadier must align and center the front sight's post with the rear sight's aperture on the DNS or use the alternate leaf sight, move the selector lever to Fire, and pull the trigger with consistent pressure. The grenadier then sets the selector lever on Safe, presses the release, pivots the barrel, and removes the expended case by hand.

To fire the **M32A1/Mk 14 MGL**, the safety lever is flipped upward to Safe, the J-shaped release handle in the forward center of the cylinder is unlocked, and the trigger/pistol grip/stock group rotated 90 degrees to the right to expose the cylinder's six breeches. The cylinder is first charged or wound by turning it 360 degrees counterclockwise to tension the rotating springs by inserting fingers into a chamber or two. The "star extractor" is marked with a semicircular arrow and "WIND." This can be done before or after chambering the rounds. The rounds are chambered in any order and the stock group rotated into firing position with an audible click when the J-shaped release locks. The weapon is shouldered, selector moved to Fire, sighted with the DNS, and any number of rounds fired semiautomatically as rapidly as the two-stage trigger is pulled. Each pull of the trigger releases tension on the rotating spring to advance the next chamber clockwise to the barrel. The cylinder is opened, tipped downward, and the J-shaped release handle pulled to eject the spent cases and rotated right to charge it.

Regardless of the particular model of GL, the elevations given in degrees achieve the stated ranges up to 350m. Since the trajectory is high and the time of flight greater at longer ranges beyond 150m, the wind may have considerable effect upon the accuracy of the projectile and the grenadier must consider this.



SHUMATE
2007



US Army Special Forces (previous pages)

While the M320 GLM began replacing the M203 within the US Army in 2009, the M203 has remained in use by all US services. This includes the M203 Special Operations Peculiar Modification (SOPMOD) kit used by SOCOM. The SOPMOD M203 is issued in each SOPMOD M4A1 accessory kit, one kit being issued per four M4A1 carbines. While the kit contains various sights and accessories to support four carbines, it contains only one shortened M203 GL with a Knight Armament Corporation quick-attach GL mount, a quick-attach leaf sight, and an AN/PSQ-18A day/night sight (using a common “AA” battery for approximately six hours’ duration). The special M203 SOPMOD barrel is only 9in long as opposed to the 12in barrel of the standard M203-series. Mounted on the M4 the 12in barrel reaches almost to the carbine’s muzzle, while the 9in barrel just reaches the forward mounting bracket. Range is not affected in spite of the loss of one quarter of the barrel’s length. The new M320A1 GLM is shown here being employed in both the under-barrel mode on an M4A1 carbine and in the standalone handheld mode. The latter mode is not as popular as originally envisioned, but some prefer it. The

M320 is somewhat more complex than the M203, a complaint expressed by some troops, but is slightly more accurate than the earlier model. Regardless, all 40mm GLs are surprisingly accurate even with simplified sighting systems. Their consistency in hits is due more to the design of the grenade and their quality of manufacture than anything else. This makes them especially effective in hitting small point targets, especially when it is necessary to target windows and firing ports. For this reason 40mm GLs are especially effective in urban combat. Grenades can easily be lobbed accurately through windows up to 125m (137yd), but urban combat ranges are generally shorter. Besides one grenade blowing away any window covering (glass, shutters, louvers, Venetian blinds, screens, wire mesh, heavy curtains), a second should immediately be fired to detonate inside the room, it being more effective to launch at least two grenades into a room to ensure most occupants are neutralized. The small and light pre-scored grenade fragments, while able to kill and wound personnel, often lack the mass and velocity to penetrate through even lightly constructed interior walls.

OPPOSITE

An ARVN grenadier guarding a freight train in 1971 wears the 1966 M79 grenade-carrier vest with two three-grenade pockets on each side of the front panel, one above the other, and two more on the small of the back. The 24 pockets were each secured by a snapped web strap. The vests were too small for many Americans and were mostly issued to the ARVN. (Tom Laemlein/Armor Plate Press)

Two New Zealanders of the 1st Australian Task Force carry empty 81mm mortar ammunition crates. The man to the left carries a 7.62mm L1A1 self-loading rifle while the other “Kiwi” carries an M79 GL. The Australians and New Zealanders allotted one M79 per rifle section (squad). (Tom Laemlein/Armor Plate Press)

CARRYING 40mm AMMUNITION

Initially, there were no special means of carrying the M79. Ammunition was issued in 54lb, 72-round, wire-bound, wooden crates with a foil-backed, white-fabric-covered, cardboard insert containing 12 six-round bandoleers that consisted of two pockets, each holding three rounds. The rounds were further held in white plastic supports – “egg carton cups” – three nose-cups molded in one unit. If the cups were removed, the rounds could easily fall out of the scant pocket flaps. The bandoleer was inadequate for long-term practical carriage, being made of flimsy materials, and did a poor job of protecting the rounds from dust, mud,





and rain. Long pyrotechnic cartridges were packed 22 to an M2A1 ammunition can (as used for .50-caliber ammunition) without bandoleers, two cans to a crate.

The first grenadiers were issued two M1956 universal ammunition cases (two M14 or four M16 20-round magazines), each holding three 40mm rounds – two nose down, one horizontally on top. Occasionally, a round was carried on each side of the cases (“pouches”) secured by the hand-grenade securing loops. Marine M1961 M14 pouches could not hold grenades, so they used bandoleers, canteen covers, and acquired Army M14 pouches.

“By the book,” basic load was initially only 18 rounds, but increased to 36. In Vietnam at least that number were carried using expedient means. One M79 grenadier reported carrying 48 HE and ten buckshot rounds. An M203-armed soldier carried 40 rounds.

Seven rounds could be carried in a 1-quart canteen cover, with grenadiers carrying 2–4 covers. An M7 bandoleer (“Claymore bag”) for an M18A1 Claymore mine held ten 40mm rounds in each of its two pockets. M3 bandoleers had seven pockets, each holding 20 rounds of clipped M16A1 ammunition. Sometimes a 40mm round was inserted in each pocket, but they bounced severely when the grenadier was running. Some squad members might carry a 40mm bandoleer that could be passed to grenadiers. ARVN soldiers sometimes had one or two M16A1

Firing from a South Korean Army hilltop firebase in 1968, this grenadier could cover a wide sector on the steep hillside with his M79 GL. A six-round bandoleer rests beside him. The bunker's wide-open firing port allows M26 hand grenades – stowed on a rack on the right – to be thrown through the port. An M17 protective mask carrying case hangs besides the grenades. (Tom Laemlein/Armor Plate Press)





bandoleers or 40mm-sized pockets sewn around the bottom hem and/or at waist-level on fatigue shirts. Most grenadiers used a combination of expedient carrying means.

In Vietnam an SF sergeant proposed different vests for riflemen, machine-gunners, and grenadiers, but only that for the grenadier was developed further. The first batch of 1966 trials M79 grenade-carrier vests were too small for Americans and so were issued to the ARVN with limited use by Americans. The vest had two three-grenade pockets on each side of the front panel, one above the other, and two more on the small of the back – 24 rounds. They required the plastic grenade-support cups.

An improved grenade-carrying vest made of nylon fabric arrived in Vietnam in late 1968. On both front panels were six grenade pockets near the bottom, four above those, and two below the shoulders – 24 pockets. In 1972, the top pockets were deepened for pyrotechnic cartridges. That vest remained in service with the 1975 All-Purpose Lightweight Individual Carrying Equipment until the Individual Integrated Fighting System (IIFS) was introduced in 1988 with its ammunition-carrying vest for M203 grenadiers. The IIFS nylon vest had only 14 HE-round pockets and four deeper pyrotechnic cartridge pockets. The overly hot and heavy nylon vest was modified in 1995 with mesh fabric and redesignated the Enhanced Tactical Load Bearing Vest (ETLBV). Unlike the Vietnam grenade vest, other web-gear items were attached to the IIFS/ETLBV.

The much-revised Modular Lightweight Load-carrying Equipment (MOLLE) was introduced in 1997, but did not see widespread use until 2002. The MOLLE allows any combinations of pockets, pouches, and

An ARVN grenadier fires at a suspected enemy position during the 1968 Tet Offensive. He carries 40mm rounds in M1956 M14 ammunition pouches and bandoleers. Some 40mm cartridges are carried on the sides of the pouches by hand-grenade securing straps. (Tom Laemlein/Armor Plate Press)



This 1st Armored Division soldier in Afghanistan is armed with an M4A1 carbine with an M203A2 UBGL. The M203's muzzle is almost 1in short of the host weapon's muzzle. He carries easy-to-reach, immediate-use 40mm rounds in single pockets on a waist belt. The carbine is fitted with a CompM4 M68 close-combat optical sight. (Tom Laemlein/Armor Plate Press)

other items to be configured and attached by Velcro®. 40mm pockets, issue and after-market, which many soldiers purchase, are available in one- and two-pocket HE grenade sets and deeper two-pocket pyrotechnic rounds with pockets for 12–18 rounds carried, sometimes “velcroed” over the chest. Additional rounds are carried in utility pouches. In recent years, nylon web belts with up to 8–12 pockets have been used.

In 2004 the US Marine Corps adopted the Improved Load Bearing Equipment (ILBE), which retained many of the MOLLE attachable pouches including the 40mm pockets.



IMPACT

Grenade launchers in action

TACTICAL IMPACT

While a 40mm HE projectile and a golf ball may travel at approximately the same speed, at short ranges (below arming range), the 1.62oz golf ball launched at about 132ft/lb will bruise, but the 6.56oz HE round launched at about 353ft/lb will without doubt severely and usually mortally penetrate a body. The HE round's energy is about the same as a 9mm Parabellum pistol round, although projectile dynamics differ.

In daylight there is neither noticeable muzzle flash nor smoke to speak of. At night there is only a small flash that lasts only a fraction of a second, or a few small sparks. An HE round detonation on the ground generates a relatively small puff of gray dust and smoke, its size and duration dependent on soil/gravel consistency, density, moisture, and wind. A few small dust spurts will be seen close around the burst, these being caused by fragments. There is little if any detonation flash within the smoke/dust cloud.

Grenade launchers are often featured in movies, television, and video games. Unfortunately, their portrayal is far from realistic: 40mm rounds do not detonate in massive fireballs, disintegrate small buildings or bunkers, destroy bridges, lift vehicles off the paving while consuming them in billowing fireballs, nor blast cartwheeling bodies out of fighting positions. One of the least realistic GL firing techniques depicted on screen involves firing one straight up for it to impact on an enemy position just meters away. Firing a GL at a near-vertical angle will simply result in the projectile ascending several hundred feet and then descending at approximately half its launch velocity slowed by air resistance – and crosswinds will have a major effect. The projectile descends base-first owing to the heavier weight. There is no possible way to fire a round near-vertically and expect any degree of accuracy – it could just as easily land in a direction opposite to that of its intended target.

A Khmer Republic grenadier prepares to fire a newly issued M79 grenade launcher as the democratic forces battle the communist Khmer Rouge outside of Phnom Penh, the capital of Cambodia. His rear sight is set for 200m (219yd) range. The traditional Khmer checkered scarf (called a *krama*) was worn by both sides as unit identification, sweat towel, sun protection, tied around feet for tree climbing, or as a sling. (Bettmann)



Grenadiers do not hesitate to fire on a single enemy soldier if more lucrative targets are unavailable. When the enemy cannot be clearly seen, which is more often than not, grenadiers fire multiple rounds at muzzle flashes, smoke, dust, moving vegetation, and fleeting glimpses of the enemy. A rapid barrage of 40mm and LMG fire often diminishes the enemy's resolve and while not necessarily prompting them to quit the field, forces them to reposition or at least reduce their fire.

It is not uncommon for grenadiers to develop a reputation within their units as being "natural" thump gunners, with a seemingly innate ability to "guesstimate" range and judge windage; but to truly be deemed a "natural," the grenadier must also be fast. An average grenadier can pump out 5–7 rounds a minute, but a natural can fire two or three more and maintain his legendary accuracy. They might be given a nickname, e.g. "Stan the Blooper Man" or "Thumper John."

The author had some experience with M79s in Vietnam, his Cambodian CIDG company having two or three per platoon. Although they were limited in number, because of the area's vegetation density no more were considered necessary. The company moved through the dense jungle in single file. Squad leaders usually led their squad with the grenadier following. When engaged, squad leaders kept the grenadier close to direct his fire. This was not a wise practice, but some squad leaders did not allow their grenadier to fire unless ordered to do so. The squad leaders denied this, as the author encouraged freedom to fire at fleeting targets. A couple of squad leaders carried the M79. Standard procedure in a firefight was for all grenadiers who could bear on the enemy location to fire three rounds as rapidly as possible while riflemen rapidly fired one or two magazines on semiautomatic and M60 gunners a half-dozen long bursts. That usually caused the enemy to lose interest and go elsewhere. If they stayed put, fire was increased and a platoon would flank them.

The company experienced only one M79 malfunction in a year and no known duds or misfires. The author, responsible for repairing all the battalion-sized strike force's weapons, never had to repair an M79. The single malfunction occurred during a firefight. An agitated grenadier low-crawled to the author indicating his M79 would not fire. Having first made certain that the M79 was unloaded, the author then locked the safety lever in the Safe position, unscrewed the stock with his P-38 can-opener, and removed the stock. Lodged between the safety lock and the safety lever interface was a hard seed no more than .12-.15in in diameter. The author picked it out, reattached the stock, and the grenadier happily crawled away to engage the enemies of democracy.

In a firefight within an abandoned village, several VC realized they were being surrounded and one at a time dashed from among the hooches. Three were hit by rifle fire, one managing to get up and flee. A 40mm round detonated 20ft in front of another and he went down, regained his feet, ran a short distance, and collapsed. During the body search it was seen that numerous fragments had struck him in the face and torso; some in the legs.

In another instance an NVA soldier was shot in the solar plexus with an unarmed HE round from about 30ft, which knocked him backward. The bottom of the round protruded from the wound and his trousers were knocked loose.

A Vietnamese farmer caught in crossfire was struck beside a kidney by an unarmed M79 HE round. He walked to a Saigon hospital and then was transferred to a US Army hospital where he was anesthetized on an operating table. A body armor-wearing surgeon, protected by a sandbag wall with a small port, first incisioned the wound site, wielding a scalpel on a 10ft pole. Using a makeshift hook on another pole he removed the grenade, which was destroyed by EOD; the farmer recovered.

The VC and NVA very much valued captured and black-market M79s. One NVA unit the author encountered appeared to have more M79s than his own unit, while a local VC company had only one or two. Either way, ammunition was scarce and they did not expend it lavishly.

Occasionally in Vietnam M79s were carried in UH-1B/G Huey gunship helicopters whose door gunners marked targets or reconnoitered by fire to flush out VC. It is extremely difficult to hit even a close-range target from a moving helicopter. They had to hover to ensure even a near-miss, which made them lucrative targets,

A female communist Khmer Rouge guerrilla, or *Mit Naree*, in Kampuchea (formally Cambodia), February 1981. M79s had been supplied by the United States to the democratic Khmer Republic in large numbers during 1971-73. With the fall of the Khmer Republic in 1975 the M79s were taken over by the Khmer Rouge and highly valued. Many had to be cannibalized for repair parts. (Photo by Alex Bowie/Getty Images)



and many pilots wisely prohibited such use. Troops transported in helicopters are required to unload GLs and carry a round to load once they have exited.

In Vietnam, gun trucks escorting convoys often carried an M79 as a “ditch gun” along with other small arms for close-in defense. The same is done today in Iraq and Afghanistan on gun trucks using M203s and M320s. Both UBGLs are used to mark and engage targets at maximum range owing to the more open terrain.

Sniping rifles and machine guns have been used to neutralize IEDs and mines, electronic jammers blocking IED-detonating cellphone/radio waves having themselves been blocked by jammers. However, mines and some IEDs do not rely on cellphone detonators and are hard-wired. Small-arms fire may disable a mine or IED, but the bullet seldom detonates stabilized explosives. An explosive projectile may set them off via sympathetic detonation and if not, thoroughly shatter the mine/IED. M203 and M320 UBGLs are used in Afghanistan and Iraq to detonate mines/IEDs. In 2004 the issue of “obsolete” M79s was requested as dedicated “counter-IED” weapons and felt to be physiologically beneficial to neutralizing a deadly threat.

Only two Medal of Honor presentations have involved GLs. Captain Riley L. Pitts (1937–67) commanding Company C, 2d Battalion, 27th Infantry, 25th Infantry Division on October 31, 1967 at Ap Dong, was the first African-American presented a Medal of Honor. After air-assaulting into a defended area, Pitts’ company was pinned down. He moved forward with an M79 firing on bunkers, rallied his company, and led an attack on more positions. To protect his men, he flung himself on a grenade, which failed to explode. Again leading his men forward, Pitts continued to fire on bunkers and fight his way through dense vegetation, urging his men forward until fatally wounded.

Sergeant Ryan M. Pitts (1985–) distinguished himself in 2d Platoon, Company C, 2d Battalion (Airborne), 503d Infantry Regiment, 173d Airborne Brigade Combat Team during the vicious Battle of Wanat in Afghanistan on July 13, 2008. The patrol base was attacked by a large Taliban force, with the initial barrage wounding many defenders including Sergeant Pitts. Severely wounded, he returned fire with his M203A1 GL on an M4 carbine and hand grenades. Finding a radio, he called in situation reports and directed fire until the attack was beaten off. He was presented the Medal of Honor and credited for preventing the base from being overrun.

There have been many acts of bravery involving GLs since Vietnam, both recognized and unrecognized with valor decorations. Examples of M32A1 MGLs include those employed by the US Marine Corps’ Company C, 2d Light Armored Reconnaissance Battalion in Afghanistan in 2006. In one engagement an enemy machine-gun position was suppressed by firing 12 rounds in a minute. The engagement lasted another ten minutes and the grenadier fired another 60 rounds, forcing the enemy to withdraw. In another engagement, 60 rounds were fired in a matter of minutes to cover troops assaulting across a field and then allow ammunition resupply. The grenadier then suppressed a machine gun and sniper and marked their positions, allowing them to be destroyed by attack helicopters.

TECHNICAL IMPACT

Few other countries have developed equivalent GLs, Germany being one. The Soviet Union was one of the first to field a UBGL. These weapons fire a “caseless” 40mm round and were designed between 1966 and 1978 by the Central Design and Research Bureau of Sporting and Hunting Weapons (TsKIB SOO) in Tula. The versions still in production are made at the Izhevsk Machine Building Plant (called Kalashnikov Concern since 2013). The first simple version was the BG-15 Mukha (Fly) mounted on the then-new 5.45mm AK-74 assault rifle and fielded in 1978. This version was replaced by the GP-25 Kostyor (Bonfire) and GP-30 Obuvka (Shoe) with improved safety features, seeing service in Afghanistan. The current production version is the GP-34 with an improved sighting system.

Poland produced the Pallad (Palladium – a chemical element) wz. 74 UBGL for mounting on AK-type assault rifles. It used a 40×47mm round, similar in design to the Western 40×46mm, but they are not interchangeable. The Pallad D wz. 83 was introduced as a standalone version of the original wz. 74 UBGL and fitted with a folding stock and AK-type pistol grip.

The Bulgaria Arsenal JSCo produces a line of 40×46mm UBGLs similar to the M203, the M7, M8, and M16 being mountable on a variety of rifles and a selection of sighting systems.

Since the mid-1990s the Russian TsKIB SOO has made the RG-6 MGL firing the GP-series UBGL 40mm caseless ammunition. It is believed to be no longer in production. Similar in layout to the Milkor six-round cylinder MGL, it differs in design details, is not as reliable, and possesses only a ladder-type folding rear sight rather than an optical system. Its performance is hampered by the lack of a sophisticated optical sight. In Croatia RH Alan makes the RBG-6 copy of the Russian RG-6.

A soldier fires the carbine version of the H&K-designed 5.56mm XM8 weapon system, which, on the verge of being standardized, was canceled in late 2005. The differences between the XM8, M4, M16, and other competing weapons were not statistically significant to warrant replacing the M4 and M16. This grenadier has an XM320 GL module fitted to his carbine by a special mounting bracket. The XM8 carbine has an integral 1.5× red dot optical sight. (US Army)





CONCLUSION

The 40mm GL has evolved from a simple, single-shot, standalone weapon into a variety of under-barrel weapons attached to rifles/carbines, as well as multishot laser-sighted weapons. From the original M79 to the under-barrel M203 and the abortive XM148 to the advanced M320, the almost 60-year evolution of the “squad’s artillery” has been a success and has provided a significant improvement to integral squad- and platoon-level fire support. Efforts to field repeating GLs in the form of the 1960s-era T148 and China Lake failed until the advent of Milkor’s M32 and its variants in the early 2000s. The repeating GL was adopted not as a replacement for single-shot GLs, but as a specialty supplementary weapon to increase point and area fire support at platoon level.

Accurate and almost as lethal as a hand grenade, the 40mm HE/frag rounds are extremely valuable. Work is underway to develop additional types of ammunition as well as efforts to improve existing munitions and their fusing.

Development of the Small Arms Grenade Munitions (SAGM) commenced in 2014 to provide a 40mm airburst capability over defilade positions. Martin Electronics, Inc. is working on an improved 4.33in-long HEDP round called the Hellhound. It offers 3.54in penetration, almost twice that of the current M433 HEDP round, and still retains a lethal antipersonnel casualty radius. Since 2007, Rheinmetall Denel Munitions has been developing an extended-range 40x51mm medium-velocity grenade for their Rippel Effect XRGL40®, which can be fired in most low-velocity GLs, increasing their range up to 700m (766yd). This ammunition is currently not used by the US military and would require new sights graduated to the extended range. Longer ranges have not been a significant issue until Iraq and Afghanistan where engagement ranges in open valleys, on broad plateaus, and among hills and mountains are frequently greater than those experienced in previous conflicts. Medium-velocity rounds are also more accurate at close and middle

ranges owing to their flatter trajectory over a greater distance than low-velocity rounds.

The US Army has made two efforts to replace 40mm GLs. The first was the 20mm XM29 Objective Individual Combat Weapon (OICW) developed in the 1990s. This consisted of a 5.56mm assault carbine based on the H&K G36 with a top-mounted semiautomatic laser-ranged GL firing 20×28mm “smart” rounds from a five-round magazine. A laser rangefinder set the range to allow airbursts over defilade positions. The OICW was too heavy, awkward, complex, costly, and the 20mm HE/frag round was not as lethal as desired. The project was canceled in 2004.

Evolving from the OICW was the XM25 Counter Defilade Target Engagement System (CDTE) or “Punisher,” a semiautomatic laser-ranged standalone GL firing 25×40mm “smart” grenades from a five-round magazine. The CDTE was developed by Alliant Techsystems and H&K and tested during 2010–13, including 18 months’ combat evaluation in Afghanistan with the 101st Airborne Division. It suffered malfunctions, some users suffered minor injuries, and it was heavy (14lb unloaded), complex, and extremely expensive. Budget cuts delayed further testing when the system was on the verge of being adopted. It is scheduled for further evolution in 2017, but units are reluctant to accept it owing to the loss of a carbine and the weapon’s weight with 36 rounds. Ammunition includes: HE-airburst, “armor-piercing” (correctly HEAT), thermobaric, door-breaching, flechette, and non-lethal. Rounds can be set for airburst forward of or over the aiming point, for point-detonation, delayed point-detonation, and window – beyond aiming point to burst inside the room. Its range is 500m (547yd) for point targets and 700m (766yd) for area. Owing to its cost and because laser-ranged 40mm HE-airburst rounds are under development, the future of the XM25 is uncertain. Its longer range is desired, though, since the Taliban uses RPK machine guns and RPGs to engage patrols at ranges of 600m (656yd) and beyond. The US Army has thus requested developmental and production funding through 2021.

Milkor USA is developing a 40mm low- and medium-velocity ammunition, semiautomatic Magazine Fed Grenade Launcher (MFGL) derived from the Rheinmetall Waffen Hydra handheld GL. Magazine capacities of four, six, and ten rounds have been tested, but considerable development effort is necessary.

40mm standalone, under-barrel, and dual-capability grenade launchers have evolved into capable and reliable small-unit fire-support weapons. The M203, M320, M32A1/Mk 14, and even the M79 will no doubt be employed on battlefields for years to come.

A US Marine sights his M203-fitted M16A4 rifle with an AN/PVQ-31A rifle combat optic sight. On the right side of the forward portion of the host weapon’s forearm is a Visible Bright Light II illuminator. The black plastic muzzle cap protecting against dust can be safely fired through. There is no muzzle cap for GLs, but tape or wadded rags or paper towels have been used. (US Marine Corps)



GLOSSARY

ANTIPERSONNEL (A-PERS)	40mm cartridge loaded with flechettes (q.v.).
AREA TARGET	Target dispersed over a small area requiring multiple 40mm grenades to neutralize: dispersed personnel or small lightly fortified positions. The target area is too far away to allow precise hits, 150–350m.
BARREL LATCH	Lever allowing the breech end of the barrel to be opened for reloading.
FIRING MECHANISM	The assembly comprising the receiver, feed/loading, trigger, safety, barrel release, and firing pin.
FLECHETTE	Small dart-like antipersonnel projectiles (pronounced “fley-SHET”). Formerly called “antipersonnel” (A-PERS) (q.v.).
FOREND	Wooden, metal, or synthetic material handgrips under or around the weapon’s foremost portion. It protects the firer from the barrel’s heat. Aka forearm.
HIGH-EXPLOSIVE ANTITANK (HEAT)	Projectile with an HE shaped charge capable of penetrating armor and hardened materials. (Pronounced “heat.”)
HIGH-EXPLOSIVE DUAL-PURPOSE (HEDP)	40mm HEAT grenade with a fragmentation capability for use against light armored vehicles, hardened barriers, and/or personnel.
HIGH- AND LOW-PRESSURE SYSTEM	An initial high-pressure propellant detonation contained in a small chamber and “bled” into a larger chamber to propel the projectile at low velocity with minimal firing signature.
MULTIPLE GRENADE LAUNCHER (MGL)	GL capable of firing multiple rounds via a semiautomatic or manual repeating feed system with 3–6 rounds: T148, China Lake, or M32. Aka MSGL.
MULTIPLE PROJECTILE (MP)	40mm cartridge loaded with buckshot pellets. (<i>Not</i> “multipurpose.”)
NON-LETHAL/LESS LETHAL	Projectiles used for civil disturbances that will not kill or have less likelihood of killing or seriously injuring personnel: tear gas, sponge projectiles, and crowd-dispersal rounds.
OGIVE	Rounded portion of the 40mm projectile’s nose containing the fuse. Aka nose cap.
PICATINNY RAIL	MIL-STD-1913 “tactical rails” or “STANAG 2324 rails” are integral track-like brackets fitted on weapons for mounting sights, night-vision devices, light sources, handgrips, and other accessories. (Pronounced “Pick uh TIN nee.”)
POINT TARGET	Small target within direct-fire range (generally 150m) that can be neutralized with one or more 40mm hits: 1–4 grouped soldiers, crew-served weapon, fighting position, firing port, window, door, “soft-skin vehicle,” etc.
POP-UP	Slang term for handheld, ground-launched, rocket-propelled colored smoke and flare signals.
QUADRANT SIGHT	Horizontal pivoting bar with front and rear iron sights. The bar may be set for elevation using an integral quadrant 50–375m range scale. May be mounted on the GL or the host weapon.
RIFLE GRENADE LAUNCHER (RGL)	Spigot or cup-type device fitted to service rifle muzzles to launch grenades and pyrotechnic signals using special launcher cartridges.
STANDALONE GRENADE LAUNCHER	GL that can be fired without being mounted on a host weapon: M79, T148, China Lake, and M32, and what are normally UBGLs fitted with a separate shoulder stock and grip; the M203 and M320 configured for standalone. Aka <i>Granatpistole</i> (grenade pistol) (GraPi) – German.
UNDER-BARREL GRENADE LAUNCHER (UBGL)	GL designed to be attached under the forearm of a host weapon for firing and providing a multipurpose weapon against point and area targets: XM148, M203, and M320. Aka Underslung Grenade Launcher (UGL) – British; <i>Anbaugranatwerfer</i> (attached grenade launcher) or <i>Anbau-Gerät</i> (attached device) (AG) – German.

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Front cover, above: A 40mm M79 grenade launcher fitted with a battered, black-painted fiberglass buttstock. New-issue stocks were dark brown. The rear leaf sight is set for direct fire. (© Royal Armouries PR.12095)

Front cover, below: A Marine assigned to Battalion Landing Team 2/5, 31st Marine Expeditionary Unit (31st MEU) participates in an enhanced marksmanship program shoot aboard the amphibious dock landing ship *USS Harpers Ferry* (LSD 49). He is armed with a 5.56mm M4 carbine mounting a 40mm M203A1 grenade launcher. (US Navy)
Title page: US Marines cautiously search a village. The M79 and other grenade launchers were of limited use at such short ranges. Buckshot cartridges were of use, however, not only because of the short range, less close-in blast and fragmentation danger to friendlies, but also because buckshot can penetrate bamboo, sheet metal, and plywood construction materials. (US Marine Corps)

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Editor's note

In this book linear, weight, and volume measurements are given in US customary units of measurement (yards, feet, inches, pounds, grains). The exception is weapons caliber, where metric is used in many cases, depending on the context. The US military habitually uses metric for weapon ranges and distances. Conversions from metric into US customary are given in the text for clarity.

Abbreviations

AG	<i>Anbaugranatwerfer</i> (attached grenade launcher – German H&K AG36)
A-PERS	antipersonnel (flechettes)
ARVN	Army of the Republic of Vietnam (pronounced “ar-vin”)
AT	antitank
CS	2-chlorobenzalmalononitrile (tear-gas/riot-control agent)
DNS	day/night sight (AN/PSQ-18A for M320)
GL	grenade launcher
GLM	Grenade Launcher Module (M320)
H&K	Heckler & Koch (“HK” when used in designations)
HE	high-explosive
HEAT	high-explosive antitank (shaped charge) (pronounced “heat”)
HEDP	high-explosive dual-purpose (shaped charge and fragmentation)
HE/frag	high-explosive/fragmentation
IAR	Infantry Automatic Rifle (M27)
LAW	Light Antitank Weapon (M72-series) (pronounced “law”)
LMG	light machine gun
MACV-SOG	Military Assistance Command, Vietnam – Studies & Observation Group (pronounced “mac-vee-sog”)
MGL	multiple grenade launcher (aka MSGL) (M32, Mk 14)
MIL-STD	Military Standard (pronounced “mil-stan”)
MP	multiple-projectile (buckshot) (<i>not</i> “multipurpose”)
rd/min	rounds per minute
RGL	rifle grenade launcher
RT	reconnaissance (recon) team (4–12 men)
SAW	squad automatic weapon (M249 – redesignated LMG in 1994) (pronounced “saw”)
SEAL	Sea–Air–Land (naval special warfare) (pronounced “seal”)
SF	Special Forces (“Green Berets”)
SMG	submachine gun (XM177E2)
SOCOM	US Special Operations Command (pronounced “so-comm”)
SOF	Special Operations Forces (collective term) (pronounced “sof”)
SOPMOD	Special Operations Peculiar Modification kit for M4A1 carbine (pronounced “sop-mod”)
STANAG	[NATO] Standardization Agreement (pronounced “stanag”)
TP	training practice (aka practice)
UBGL	under-barrel grenade launcher (XM148, M203, M320)
USALWL	US Army Limited War Laboratory
WP	white phosphorus (burning-type white screening smoke and casualty-producing incendiary compound) (“Willie Pete”)

RGL is a non-standard abbreviation, but used in this work to differentiate between standalone and 40mm under-barrel grenade launchers as opposed to spigot and cup-type grenade launchers that attached to rifle muzzles.